# THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED

The Aluminum World—Copper and Brass—The Brass Founder and Finisher

ELECTRO-PLATERS REVIEW

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# Institute of Metals Division Meeting

**A Report of the Winter Meeting of the Institute of Metals Division, Held February 18-19, 1931. Abstracts of Papers on Metal Working and Metal Structure**

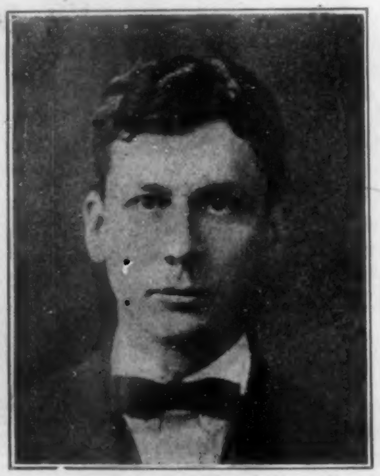
THE winter meeting of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers for 1931, was held on February 18th and 19th at the Engineering Societies Building in New York. Three sessions were held, two on the working of metals and one general session. The papers covered a wide variety of subjects from the practical methods involved in forming and working metals, to the highly abstract considerations in metallic structure and X-ray investigation.

The annual lecturer for this year was Dr. Arne Westgren, Professor of General and Inorganic Chemistry at the University of Stockholm, Sweden. Dr. Westgren spoke on the subject of the X-Ray Determination of Alloy Equilibrium Diagrams, showing how by the aid of the X-ray, analyses of various constituents of alloys could be determined with a high degree of accuracy. Dr. Westgren will remain in the United States for a time, giving lectures in various metallurgical centers.

The annual dinner of the Division was held Thursday,

## New Officers of the Institute

**SAM TOUR**
**Chairman**



**Dr. C. H. MATHEWSON**
**Vice-Chairman**

**W. M. CORSE**
**Secretary-Treasurer**

February 19th, at the Hotel New Yorker, at which Dr. G. W. Thompson, Chief chemist of the National Lead Company, spoke on the subject of Lead. Dr. Thompson gave a comprehensive metallurgical and economic review, touching on the growth of the industry, the major fields of consumption, the properties, advantages and limitations of lead and the importance of secondary lead and its proper refining.

**Dr. ARNE WESTGREN,**
**Who Delivered the Annual Institute of Metals Division Lecture**

The institute of Metals lecturer for 1932 will be Dr. Paul D. Merica, Technical Assistant to the President of the International Nickel Company of New York.

**New Officers for 1931-2**

The new officers of the Division for 1931-1932, who were elected unanimously, were as follows:

**Chairman:** Sam Tour, vice-president, Lucius Pitkin, Inc., New York.

**Vice-chairmen:** John R. Freeman, Jr., American Brass Company, Bridgeport, Conn.: Dr. C. H. Mathewson, Professor of Metallurgy, Yale University, New Haven, Conn.

**Secretary-Treasurer:** William M. Corse, consulting metallurgist, Washington, D. C.

**Executive Committee:** Zay Jeffries, T. S. Fuller, W. A. Scheuch, G. E. Johnson, Arthur Phillips, W. M. Peirce, A. J. Phillips, G. C. Riddell, J. L. Christie, H. M. Williams.

The meetings were attended not only by the regular group of Division members but by a large number of members of other Divisions of the American Institute of Mining Engineers, who are showing increasing interest in the work of the Institute of Metals Division, which has grown to be one of the most popular sections of the A. I. M. E.

Abstracts of the papers read at the sessions are given below.

# Abstracts of Papers

### FORMING PROPERTIES OF THIN SHEETS OF SOME NONFERROUS METALS

By W. A. Straw, M. D. Helfrick and C. R. Fischrupp

Data on forming tests are summarized to show the minimum radii of 90° forming tools that produce acceptable bends in some thicknesses and tempers of some brass, phosphor bronze and nickel silver sheet.

A numerical relationship between the thickness of the sheet and the radius of the tool that forms acceptable bends is not attempted in view of the effect of variation in grain size, temper and composition of the materials.

Experience in the application of the data presented has demonstrated the practicability of using them in designing formed parts and forming tools.

### DIE PRESSING OF BRASS AND COPPER ALLOYS

By John R. Freeman, Jr.

The die pressing of brass may be described as a method of producing irregularly shaped parts of brass and other copper alloys by hot deformation in a die under pressure. Die pressing of brass was first developed as an improvement on sand castings in order to obtain irregularly shaped articles of brass with superior surfaces, a closer tolerance in dimensions, a denser structure, freedom from porosity and elimination of the relatively large amount of scrap invariably attached to sand castings. The freedom from sandy surfaces with consequent greater tool life in machining operations was also recognized as well as elimination of losses due to the uncovering of blowholes in machining operations. Die pressing also gave alloys of superior strength.

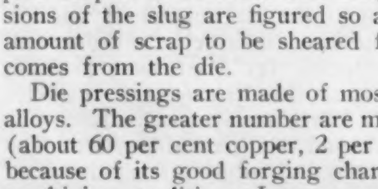
Die pressings today are made from extruded rod or shapes, according to design of the part to be made. The greater number of pressings are made from round rod, because of its relatively lower cost and ease of handling. The rod is first sheared or sawed into desired lengths, the diameter of rod used and length of "slug" or "rivet" depending upon ultimate weight and shape of the die-pressed part to be made and design of die. The dimensions of the slug are figured so as to give the minimum amount of scrap to be sheared from the pressing as it comes from the die.

Die pressings are made of most all of the copper-base alloys. The greater number are made of leaded high brass (about 60 per cent copper, 2 per cent lead, balance zinc) because of its good forging characteristics and excellent machining qualities. Large numbers are also made of the aluminum bronzes, manganese bronze, Tobin bronze, nickel silver and more recently of Everdur.

### PLASTICITY OF COPPER-ZINC ALLOYS AT ELEVATED TEMPERATURES

By Alan Morris

1. A series of drop-hammer tests at elevated temperatures has been made on brasses ranging upward from 62.0 per cent copper. The alloys usually considered most difficult to hot-work show the least plasticity.



**Dr. G. W. THOMPSON,**
**Who Gave a Review of the Economics and Metallurgy of Lead**

2. The drop-hammer test as a means of predetermining whether a metal or alloy will crack in hot-working must be used with judgment, since the severity and nature of the hot-working process must be given due weight.

3. Alpha brasses that have been heated so as to develop a

large grain appear to have a greater tendency to crack than samples of the same alloy that have not been so overheated.

4. A method of calculating the average resistance of the sample to the blow is offered, which may prove to be a means of correlating the work of various investigators, though they have used samples of different sizes and different weights of blow.

5. The calculated resistances of lead, tin, aluminum and zinc at room temperature are compared with the plastic flow points, as determined by ordinary test. The relation between these two quantities varies with the different metals. The calculated resistance of lead, tin and zinc are much higher than the plastic flow points, while in aluminum the difference is not so great. This difference is mainly accounted for, probably, by the greatly increased speed of deformation under the hammer, but to some extent may be due to strain-hardening.

### METAL WORKING IN POWER PRESSES

By E. V. Crane

A tremendous volume of the metal rolled annually into sheets, strips and coil stock finds its way to a host of stamping and manufacturing plants which are the quantity production units of the country. Considerable in volume, too, are the rolled and extruded rods which go into forging and manufacturing plants for conversion into the same general line: those widely sold metallic necessities and luxuries of the household, the office, transportation, farming and building construction.

Yet, in spite of its age and its importance, the stamping trade has been doing its "engineering" largely by trial and error. Its distinctive method is shearing out and plastically working metal to finished shape in a few quick strokes with high loads and expensive tools which are warranted only by large quantities to be produced.

The principal operations have many features in common with rolling and wire-drawing methods. Combinations of stresses are different, however, and details of operations are infinite in variety. An engineering study of the subject begins with stress analysis, but must go back to metallurgy for its foundation.

A grouping of pressed-metal working operations according to whether the metal is (1) sheared, (2) bent, (3) drawn or (4) squeezed has proved useful. All of these groups include instances of both hot and cold operations. For discussions of metal working properties, the division between hot and cold working is taken as the recrystallization range of temperature. This, of course, brings tin, lead and often zinc into the hot-work range at or near room temperature. The outstanding hot-working press field is in forging: particularly of brass; all of which is included in the squeezing group.

### NICKEL-CLAD STEEL PLATE WORK

By William G. Humpton, F. P. Huston and Robert J. McKay

The manufacture of nickel-clad steel plate and the fabrication of articles from it has progressed far enough to permit a general description of the working methods used. The manufacture of sheets made up of layers of nickel and steel is not new as a sheet of this character was patented in Germany in 1893. Present development differs mainly in the size and finish of the product. The earlier light-gage highly finished products have been limited in their application due to their similarity, in certain respects, to electro-plated and highly finished alloy sheets. The new product is a relatively heavy plate ¼ or ⅜ in. thick and heavier, with one side coated with nickel, the weight of nickel being of the order of 10 per cent of the whole. The finish is that of hot-rolled steel plate.

### TEXTURE OF METALS AFTER COLD DEFORMATION

By Franz Wever

Starting with the conception that only a complete and unprejudiced interpretation of the X-ray data can appropriately serve as the basis for the deduction of the relationships between the orientation of the crystallites in a cold-worked metal and the inner slip mechanism of that metal, a new method for describing conditions of statistical anisotropy with the aid of pole figures was described. The simple relationships of these figures to the X-ray diffraction patterns are shown and an example is discussed which shows the conversion of the X-ray patterns to pole figures by means of graphic charts.

The formation of the texture by drawing, cylindrical compression, rolling and plane parallel compression was described by means of pole figures for the limited case of cubic metals with face-centered and body-centered lattices.

The known laws of plastic deformation of face-centered cubic single crystals are used to elucidate the

**W. M. PIERCE**
**Executive Committee**

**W. A. SCHEUCH**
**Executive Committee**

**H. M. WILLIAMS**
**Executive Committee**

deformation process of a crystallite in a structure. In this, particular importance was given to the mechanism of the plastic bending of the crystal. Systematically following the changes in position of randomly orientated crystallites in an axially symmetrical deformation process leads to a texture which is found experimentally to contain those crystallite orientations, in stable or labile positions, for which no further lattice rotation occurs.

**T. S. FULLER**
**Executive Committee**

The texture of aluminum after plane parallel deformation is described as a superposition of parts of textures produced by axially symmetrical tension and compression with their axes respectively in the direction of flow and of compression of the deformation process.

Crystallite positions which were found by experiment to differ from those which are to be expected from theoretical considerations were investigated by means of various deformation textures of aluminum and the findings were accounted for by means of the processes of deformation and strengthening of single crystals.

Propositions 3 and 4 are extended to the body-centered cubic structure under the assumptions that the (011) plane is the plane of slip and that the direction 111 is the direction of slip.

Inasmuch as plane parallel deformation is closely related to the rolling process, which is also confirmed by the similarity of their textures, we arrive at a unified viewpoint from which to consider the important deformation textures. Its basis lies in the well-known mechanism of deformation of single-crystals.

## EFFECT OF COMBINATIONS OF STRAIN AND HEAT TREATMENT ON PROPERTIES OF SOME AGE-HARDENING COPPER ALLOYS

By W. C. Ellis and Earle E. Schumacher

Hard drawing subsequent to heat treatment materially increased the strength without appreciably increasing the resistivity of copper alloys containing either nickel and silicon or cobalt and silicon. The copper-nickel-silicon alloy containing a nominal 4 per cent of nickel plus silicon had a maximum strength of 140,000 to 150,000 lb. per sq. in. associated with a conductivity of 30 to 33 per cent of annealed copper. The copper-cobalt-silicon alloy containing a nominal 1 per cent of cobalt plus silicon had a strength of 85,000 lb. per sq. in. and a conductivity of approximately 50 per cent of that of annealed copper. Increasing the amount of hardener to 3 per cent did not improve the strength or increase the conductivity of this alloy. No improvement in strength resulted from adding cadmium to a copper-nickel-silicon composition.

The aging of heat-treated and hard-drawn wires at temperatures below 500° C. increased the conductivity in alloys containing both nickel and silicon, and cobalt and silicon. The increase was decidedly greater, however, in alloys containing nickel and silicon. If the aging temperature was above 300° C., the tensile strength was adversely affected. The end properties, therefore, depended upon the choice of aging conditions.

It has been shown that strain accelerates the rate of precipitation of nickel and silicon from quenched dispersion-hardening copper-nickel-silicon alloys which determines to some extent the end properties obtained under given aging conditions.

## FABRICATION OF THE PLATINUM METALS

By C. S. Sivil

This page was a resumé of the methods of handling the platinum metals. It covered the early methods of manufacture, melting, refractories, ingot molds, arc melting, induction melting, atomic hydrogen melting, working, rhodium, iridium, ruthenium and osmium.

## SUPPRESSED CONSTITUTIONAL CHANGES IN ALLOYS

By G. Sachs

X-ray analysis and single-crystal study have been utilized in recent years as a new means of following constitutional changes in alloys. If such transformations can be suppressed by rapid cooling, they can be followed at room temperature in a particularly convenient manner. In this paper are considered changes in solubility and polymorphic transformations with particular reference to phenomena of the age-hardening type. Finally a thermodynamic viewpoint is developed for examining such transformations.

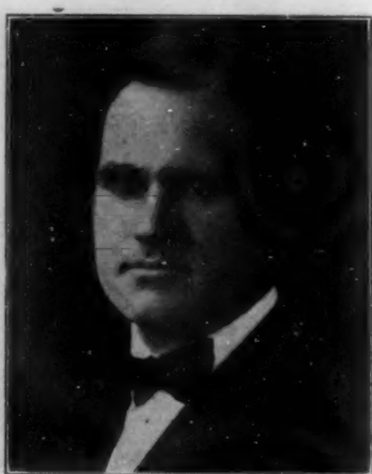
## CONSTITUTION OF HIGH-PURITY ALUMINUM-TITANIUM ALLOYS

By William L. Fink, Kent R. Van Horn and P. M. Budge

The investigation of the phase relations of high-purity aluminum-base alloys is a part of the fundamental research program of the laboratories of the Aluminum Company of America. The results of a number of binary and ternary systems have previously been published in the transactions of this society. The aluminum end of the binary aluminum-titanium system has been studied. The indications are that most, if not all, of the titanium is accounted for by the compound $TiAl_3$

## STUDIES UPON THE WIDMANSTÄTTEN STRUCTURE, II.—THE $\beta$ COPPER-ZINC ALLOYS AND THE $\phi$ COPPER-ALUMINUM ALLOYS

By Robert F. Mehl and O. T. Marzke



**DR. ZAY JEFFRIES**
**Executive Committee**

1. The $\beta$ copper-zinc alloys precipitating the $\alpha$ phase and those precipitating the $\gamma$ phase have been studied from the point of view of the Widmanstätten figure.

2. Proof is given that the $\alpha$ precipitate takes the form of true needles, the position and lattice orientation of which are determined by the orientation of the $\beta$ lattice.

3. The direction in the $\beta$ lattice taken by the $\alpha$ needles is approximately [111]. Evidence is advanced

that three separate families of needles cluster around each [111] direction, which would require a total of twelve families of needles. Measurements of angles between these three families of needles indicate that the true needle direction is approximately [556].

4. The $\gamma$ precipitate first forms a complex starlike structure. On reheating of quenched specimens the starlike structure divides into a number of minute well-formed polyhedrons.

5. The lattice plane in the $\beta$ phase defined by the intersecting planes forming the stars is the (110) plane, and the plane enclosing the polyhedrons is likewise the (110) plane.

6. The precipitate from the $\alpha$ phase in the Cu-Al system, like that in the Cu-Zn system, is in the form of true needles.

7. The direction in the $\beta$ lattice taken by these needles appears to be the same as that defined by the $\alpha$ needle in the copper-zinc system.

8. It is pointed out that the present work, taken with previous work, shows that the Widmanstätten figure may be formed of needles, plates or polyhedrons.

9. The Widmanstätten figures obtained lead to the conclusion that the lattice structure of the parent solid solution is not the only controlling factor. It seems certain that in every case the figure forms as a result of an interaction between the lattice of the parent solid solution and that of the precipitate.

10. It is suggested that the structural analogies observed in metal systems may extend to analogies in Widmanstätten figures.

### A THERMODYNAMIC STUDY OF THE EQUILIBRIA OF THE SYSTEMS ANTIMONY-BISMUTH AND ANTIMONY-LEAD

By Yap, Chu-Phay

This paper is divided into two parts: Part I deals with the Sb-Bi system and Part II deals with the lead-rich side of the Sb-Pb system. Although the former system has not much practical interest now, it has great theoretical interest in that it is the one system that for a long time was thought to have (and under specific conditions still has) an anomalous solidus, which no amount of physical investigation could adequately account for. The latter system of course, is particularly interesting in the lead-rich end. It will be shown that the thermodynamic method is capable of predicting reliably the equilibrium position of the solidus, and thus acts as a check on the experimentally derived solidus.

### ARSENIC ELIMINATION IN THE REVERBERATORY REFINING OF NATIVE COPPER

By C. T. Eddy

The origin of the arsenic in Lake Superior copper is traced and its effect on the properties of the metal is described.

A comparative study is given of the effect of arsenic on the electrical conductivity of lake copper in the cast, hard-drawn and annealed states. Because of segregation in the cast bar, the test wires containing more than 0.10 per cent arsenic give higher conductivities when hard drawn than after annealing. Prolonged heating of the cast bar overcomes this tendency, so that the curves representing the hard-drawn and annealed states become practically contiguous.

The electrical conductivity is a straight-line function of the logarithm of the arsenic content in the range 0.10 to 1.0 per cent arsenic, but, because of the complexity of the relationship, no equation tenable for the whole range from 0.0 to 1.0 per cent arsenic is attempted.

Data relevant to arsenic elimination by the soda-ash method are given, and the soda consumption is computed. It is shown that important influences are exerted, not only by the temperature of the bath, but also by the concentration of the oxygen and by the mode of introduction of the soda. The effect of varying concentrations of oxygen is illustrated, and the optimum oxygen concentration deduced. An oxygen content of 0.85 per cent results in the least soda consumption. The formation of copper arsenate is shown to have little effect on the arsenic elimination, but all of the arsenic must be present in the pentavalent condition.

Data are given to illustrate the relationship between the initial arsenic concentration in the bath and the amount of soda required for its removal; from these data, the probable soda consumption for any furnace charge containing any amount of arsenic from a very little to 0.4 per cent may be estimated.

### DIRECTIONAL PROPERTIES IN COLD-ROLLED AND ANNEALED COPPER

By Arthur Phillips and E. S. Bunn

The most significant disclosure of this experimental work is fairly obvious and may be expressed in a few words. Rather pronounced directional tendencies may be produced in copper by the combined effects of heavy reductions and high temperatures of anneal. It is entirely reasonable to assume that the directional differences of the order found may account to a large extent for the local elongation which results in the formation of ears in drawn copper. In order to avoid serious directional properties in copper, it appears desirable to limit the final reduction to about 50 to 60 per cent. and the final anneal to 500° to 600° C.

The authors wish to state at this time, however, their belief that the differences reported in this paper would be modified and perhaps the order entirely reversed, by marked differences in the preliminary history of the material. For example, if the last annealing temperature, prior to the reductions, had been 800° C. instead of 550° C. there is reason for believing that directional properties of a different nature and order would have been encountered. Further work on the effect of the "get ready" anneal is now being planned and it is hoped that additional data on this subject will be obtained in the near future.

## Etching Tin

Q.—Kindly tell us what acid should be used to etch a pattern in tin, the same as they do in engraving. If you could at the same time give any information regarding the precedure to be used in this work, it would also be highly appreciated.

A.—Hydrochloric acid is used for etching tin. The strength of the solution depends entirely upon the quality of the resist. It is a better plan to use a 10% solution and have slow etching so as to obtain depth of etch without undercuts.

In the engraving trade the plate to be etched is placed in the bottom of a rocking tray and just enough acid is used to keep a flow of acid over the surface of the plate as the device rocks. This washes off the dissolved metal and presents a clean surface to the acid and, therefore, accelerates the etching process.

G. B. H.

# A New Silicon-Zinc-Copper Alloy

By DR. E. VADERS

Hirsch, Kupfer- und Messingwerke A.-G., Finow (Mark), Germany.

## The Use of Silicon as a Deoxidizer and Alloying Agent—Preparation of the Alloys—Determination of Solid Solubility Limits — Mechanical and Physical Properties — Part 1.

THE use of silicon in the preparation of copper alloys has been known for only a few years, but its use as a deoxidizer for a much longer time. As such, silicon has the advantage over phosphorus that an excess has not nearly so deleterious an effect on the alloy as the same excess of phosphorus. It has also been recognized that small quantities of silicon increase the tensile strength of copper appreciably, so that the resulting alloy is more suitable than pure copper for the manufacture of conductor wires, and its conductivity is not very seriously diminished; 0.02-0.5 per cent. of silicon reduces the conductivity of copper only to 98 per cent.

Except as a means of introducing silicon into alloys pure silicon-copper alloys have, up to the present, found no technological use. Nor have similar alloys with additions of iron and manganese or nickel, cobalt, chromium, tungsten or molybdenum been used to any extent, although such alloys were prepared in Germany in 1921 in the Institut für Metallüttenwesen und Metallurgie at Aachen.[1] Borchers, under whose direction this work was carried out, hoped to be able to use silicon-copper alloys as substitutes for tin-bronzes. With the same object in view, other workers have prepared numerous special alloys, most of which suffered from the disadvantage of being unworkable hot or of being worked only with difficulty with cutting tools.

Corson[2] discovered the age-hardening possibilities of silicon-nickel-copper alloys and other combinations with silicon and copper. But the age-hardened silicon-copper alloys do not satisfy all requirements—for example, their elasticity is, in no case, as great as that of the ordinary hard-rolled phosphor-bronzes. Again, the preparation of these alloys in uniform quality presents great difficulty, as the quenching and ageing temperatures must be kept within very narrow limits in order to avoid large deviations in the values of the mechanical properties.

Besides its use in the preparation of new alloys, especially those of copper and aluminium in which silicon forms an important part of the alloy, the element has been added in small quantities to many old and well-known alloys—e.g. "aluminium-bronzes," copper-tin alloys, and copper-zinc alloys. As the last named are of the most interest among copper alloys, the influence of silicon on them has naturally been more thoroughly investigated. Guillet[3] concluded, as the result of his researches, that the maximum permissible silicon content of copper-zinc alloys was dependent on the zinc content of the alloy, the greater the zinc content the smaller was the amount of silicon that could be added before the separation of a new constituent rendered the alloy too brittle. Table I. shows the silicon content which, according to Guillet, first causes this new constituent to separate from certain copper-zinc alloys.

As will be seen, the new constituent appears in the 63.61 per cent copper alloy with 2.55 per cent of silicon, and in the 57.9 per cent copper alloy with 1.96 per cent of silicon. Guillet's work was almost entirely confined to a study of the effect of silicon on the ordinary brasses—i.e. on those containing 57-70 per cent of copper, and no systematic work was done on the behavior of silicon in zinc-copper alloys with a higher copper content than 70 per cent; he simply stated that about 2 per cent of silicon entered into solid solution in the 90 per cent copper alloy. This assumption of Guillet, and his statement that only small quantities of silicon could advantageously be added to brass, had the effect of deterring other workers from further investigating the ternary system silicon-zinc-copper. The results of the present work, however, show that silicon-zinc-copper alloys with a higher content of silicon than those prepared by Guillet are technologically useful, provided that the copper content is sufficiently high. Whilst Guillet stated that zinc-copper alloys with more than 2 per cent silicon were too brittle for use, it will be seen from what follows that quite valuable alloys can be prepared containing more than 2 per cent silicon when the copper content exceeds 70 per cent. The mechanical properties and the technical uses of those alloys form the principal objects of the present paper, but first details will be given of the methods used in establishing the boundary of the region of solid solubility of silicon in $\alpha$-zinc-copper alloys.

### THE SOLID SOLUBILITY OF SILICON IN $\alpha$ BRASS

The materials used in the preparation of the alloys were electrolytic copper, pure zinc, and silicon containing 1-2 per cent iron. As the silicon content of the alloys studied did not exceed 6 per cent in any case, the iron introduced by the impure silicon did not exceed 0.06-0.12 per cent—a quantity which is permissible as an impurity. The alloys were melted in carbon crucibles in a high-frequency induction furnace, and for the preparation of less than 2 kg. of alloy it was found unnecessary to use a silicon-copper "hardening alloy." The copper and silicon, the latter in small pieces, were placed in alternate layers in

TABLE I.

| No. | Composition Per cent. Copper | Silicon | Structure |
|---|---|---|---|
| 1 | 69.15 | 0.35 | $\alpha$ |
| 2 | 68.84 | 0.81 | $\alpha$ |
| 3 | 68.26 | 1.41 | Traces of a new constituent |
| 4 | 64.03 | 0.96 | Resembling brass with 59 per cent. copper |
| 5 | 64.30 | 1.77 | New constituent |
| 6 | 63.61 | 2.55 | " " |
| 7 | 65.62 | 4.15 | Resembling brass with 58.5 per cent. copper |
| 8 | 59.99 | 0.20 | " " " " " " |
| 9 | 59.83 | 0.30 | " " " " " " |
| 10 | 59.69 | 0.81 | " " " " " " |
| 11 | 59.41 | 1.37 | " " " " " " |
| 12 | 59.12 | 2.50 | " " " " " " |
| 13 | 60.05 | 4.51 | New constituent |
| 14 | 57.56 | 0.35 | Resembling brass with 56.5 per cent. copper |
| 15 | 57.81 | 0.86 | " " " 50-54 " " |
| 16 | 57.09 | 1.96 | New constituent |

[1] Abhandl. Inst. Metalhüttenw. Tech. Hochsch. Aachen, 1921, 1, (3).
[2] Iron Age, 1927, 119, 353.
[3] Rev. Mét., 1909, 6, 252.

the crucible, the mixture covered with a layer of wood charcoal to prevent oxidation and melted in the usual way, and finally the zinc was added to the molten alloy at 1000°-1100° C. The alloys were cast, for the tensile tests, in sand-moulds to obtain rods 16 mm. in diam. and 20 cm. long. Table II shows the results of the tensile tests. The elongation is calculated on a length equal to 11.3 times the diameter. Hardness measurements were made with a 10-mm. ball under a load of 100 kg. applied for 30 seconds. These remarks apply also to the figures in succeeding tables. Copper and silicon only were determined by analysis; zinc was taken by difference.

Small pieces were cut from these tensile specimens and used for the determination of the equilibrium diagram. They were annealed for 8 hrs. at 750° C. in an electric muffle with temperature regulator and allowed to cool slowly in the furnace. After cutting and polishing, the sections were etched with a 10 per cent solution of ammonium persulphate and photomicrographs made (Figures 2-11), from an examination of which the position of the boundary line *ab* in Fig. 1) for the solubility of silicon in α brass was deduced. Perhaps it would be more correct to call the line *ab* the boundary of the solid solution range at the copper corner of the ternary system silicon-zinc-copper. In Fig. 1 alloys 2, 6 and 9 of Table 11, which gave the structures shown in Figures 3, 7 and 10, and all alloys which showed similar homogeneous, ternary, solid solution structures are represented by small circles, whereas alloys 1, 4, 5, 7, 8 and 10 of Table II. (Figures 2, 5, 6, 8, 9 and 11), which showed a duplex structure are represented by black dots on the other side of the line *ab*. In the structure of this second class of alloys a new crystal phase having a bluish color can be recognized—e. g. in Figure 2 a large bluish crystal appears in the middle of the photograph; in Figure 5 two such crystals may be seen, one at the top and one at the bottom edge, and in Figure 6 the blue crystals are again in the middle. Unfortunately, the photographs do not clearly show that these crystals are a new silicon-rich phase, as their characteristic blue color cannot be seen, but the appearance of the crystals is a sufficient indication that they are not precipitations of previously dissolved silicon. The assumption that the crystals are a new compound is also probably incorrect, although it would appear that Guillet had this possibility in mind when he referred to them as a special constituent. It is much more likely that these blue crystals which form when the boundary

Fig 1.—Ternary System Silicon-Zinc-Copper showing the Solubility Curve of Silicon.

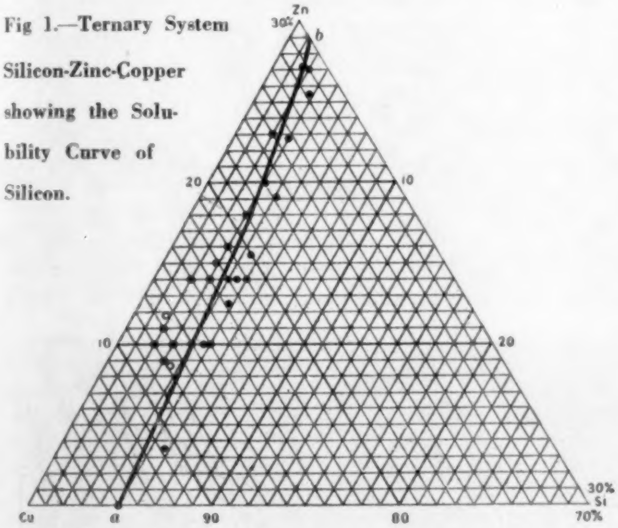



TABLE II. TENSILE PROPERTIES OF SAND-CAST SILICON-ZINC-COPPER ALLOYS.

| No. | Composition by Analysis (Per Cent) Copper | Silicon | Zinc | Tensile Strength, Kg./mm.² | Elongation on 11.3 × Diam., Per Cent | Brinell Hardness, 10/1000/30 |
|---|---|---|---|---|---|---|
| 1 | 90.77 | 5.93 | 3.5 | 23.4 | (?) | 115.0 |
| 2 | 94.80 | 5.00 | ... | 31.5 | 10.5 | 77.1 |
| 3 | 82.70 | 4.89 | 12.0 | 50.8 | 10.0 | 155.0 |
| 4 | 80.13 | 4.54 | 15.0 | 49.7 | 9.45 | 142.0 |
| 5 | 76.87 | 4.06 | 19.0 | 44.8 | 6.1 | 140.0 |
| 6 | 87.72 | 3.50 | 8.5 | 34.9 | 4.0 | 92.1 |
| 7 | 74.29 | 3.09 | 22.5 | 36.9 | 5.05 | 117.5 |
| 8 | 71.76 | 2.96 | 25.0 | 36.7 | 2.2 | 135.0 |
| 9 | 86.47 | 1.92 | 11.5 | 25.0 | 28.3 | 80.0 |
| 10 | 71.15 | 1.87 | 27.0 | 35.65 | 14.6 | 104.0 |

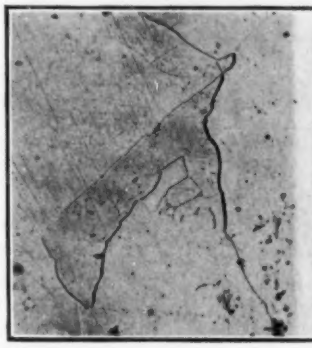


Fig. 2.—90.77 per cent. copper, 5.93 per cent. silicon, rest zinc. Annealed for 8 hrs. at 750° C. and slowly cooled, showing separation of silicon compound. Etched with 10 per cent. $(NH_4)_2S_2O_8$ solution. × 400.

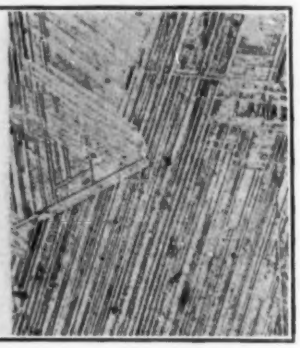


Fig. 3.—94.80 per cent. copper, 5.00 per cent. silicon, rest zinc. Annealed for 8 hrs. at 750° C. and slowly cooled. Silicon in solid solution. Etched with 10 per cent. $(NH_4)_2S_2O_8$ solution. × 400.

Fig. 4.—82.70 per cent. copper, 4.89 per cent. silicon, rest zinc. Annealed for 8 hrs. at 750° C. and slowly cooled. Silicon compound precipitated. Etched with 10 per cent. $(NH_4)_2S_2O_8$ solution. × 400.

Fig. 5.—80.13 per cent. copper, 4.54 per cent. silicon, rest zinc. Annealed for 8 hrs. at 750° C. and slowly cooled. Silicon compound precipitated. Etched with 10 per cent. $(NH_4)_2S_2O_8$ solution. × 400.

Fig. 6.—76.87 per cent. copper, 4.06 per cent. silicon, rest zinc. Annealed for 8 hrs. at 750° C. and slowly cooled. Silicon compound precipitated. Etched with 10 per cent. $(NH_4)_2S_2O_8$ solution. × 400.

Fig. 7—87.72 per cent. copper, 3.50 per cent. silicon, rest zinc. Annealed for 8 hrs. at 750° C. and slowly cooled. Silicon in solid solution. Etched with 10 per cent. $(NH_4)_2S_2O_8$ solution. × 400.

Fig. 8.—74.29 per cent. copper, 3.09 per cent. silicon, rest zinc. Annealed for 8 hrs. at 750° C. and slowly cooled. Silicon compound precipitated. Etched with 10 per cent. $(NH_4)_2S_2O_8$ solution. × 400.

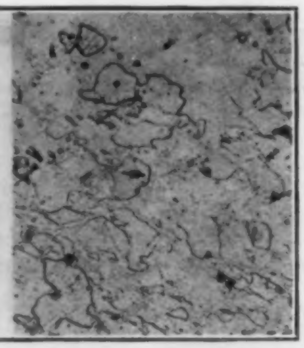


Fig. 9.—71.76 per cent. copper, 2.96 per cent. silicon, rest zinc. Annealed for 8 hrs. at 750° C. and slowly cooled. Silicon compound precipitated. Etched with $(NH_4)_2S_2O_8$ solution. × 400.

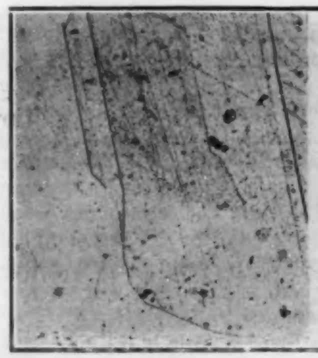


Fig. 10—86.47 per cent. copper, 1.92 per cent. silicon, rest zinc. Annealed for 8 hrs. at 750° C. and slowly cooled. Silicon in solid solution. Etched with 10 per cent. $(NH_4)_2S_2O_8$ solution. × 400.

Fig. 11—71.15 per cent. copper, 1.87 per cent. silicon, rest zinc. Annealed for 8 hrs. at 750° C. and slowly cooled. Silicon compound precipitated. Etched with 10 per cent. $(NH_4)_2S_2O_8$ solution. × 400.

line ab is overstepped are crystals of a new silicon-rich ternary solid solution. This is almost certainly true for the copper-rich alloys, but for alloys with a lower copper content—e.g., alloys with 60 per cent copper and 3-4 per cent silicon—no further miscibility appears to occur.

Alloy 2 shows a most interesting microstructure (Figure 3) but no explanation can be advanced for the appearance of the parallel lines within the individual crystals. It is possible that they indicate a decomposition of the solid solution in a manner similar to that which occurs in the binary system palladium-antimony. In this case the solid solution containing 59.6 per cent palladium decomposes at 528° C. with the evolution of heat into light and dark lamellæ. In the silicon-zinc-copper system thermal analysis does not aid in the establishment of the solid solution boundary. Solely for control purposes, however, three cooling curves of alloys in this system were taken. The results are shown in Figure 12.

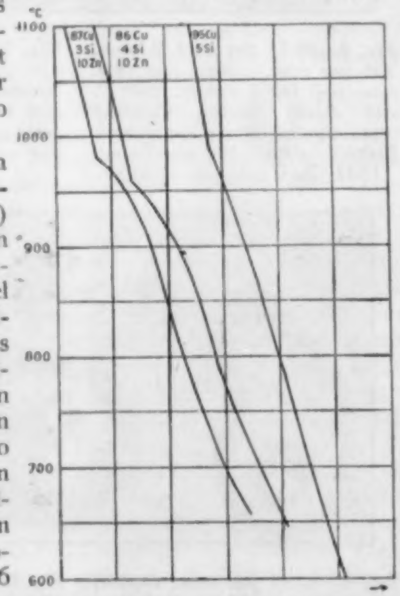



Fig. 12.—Cooling Curves of Silicon-Zinc-Copper Alloys.

It will be seen that the shape of the curves is typical of alloys which freeze with the formation of solid solutions. The cooling curve corresponding with the 3:10:87 silicon-zinc-copper alloy (87.31 per cent copper, 2.96 per cent silicon by analysis) shows a break at 980° C. when solidification commences, then becomes concave up to the turning-point at 850°-860° C., and finally becomes convex without showing any definite second break. As is well known, the second break, indicating the ending of the solidification, does not appear in the cooling curves of alloys which solidify as solid solutions, owing to imperfect diffusion. The cooling curve of the 4:10:86 alloy (86.23 per cent copper, 3.97 per cent silicon by analysis) is almost the same as that of the 3:10:87 alloy, but the transition from the concave to the convex form is accompanied by a second, but much smaller, break at 780° C. If it be assumed that this break denotes the beginning of the separation of a second crystal phase, then thermal analysis confirms the microscopic examination, for, according to Fig. 1, the 4:10:86 alloy lies directly on the boundary line *ab*. The third alloy of which the cooling curve was taken was the 5 per cent silicon-copper alloy (Fig. 12). As will be seen from the shape of the curve, the rate of fall of temperature in this case (readings were taken every 10 seconds) is much greater than in the other two just discussed, and the turning-point is not nearly so clearly

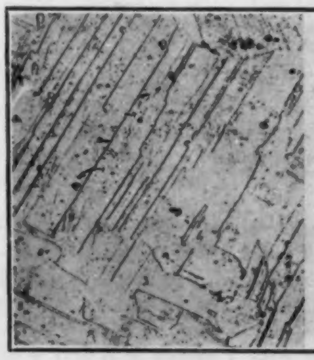


Fig. 13.—77 per cent. copper, 3 per cent. silicon, 20 per cent. zinc. Drawn. Etched with 10 per cent. $(NH_4)_2S_2O$ solution. × 400.

Fig. 14.—76 per cent. copper, 3 per cent. silicon, 1 per cent. tin, 20 per cent. zinc. Drawn. Etched with 10 per cent. $(NH_4)_2S_2O_8$ solution. × 400.

marked; this is due to the fact that a small quantity of metal was used in the experiment. Nevertheless, this curve is again typical of a solid solution alloy, for only one break (at 995° C.) appears, at any rate down to 600° C., indicating that the 5 per cent silicon-copper alloys consist of a homogeneous solid solution. This is in agreement with the microscopic examination (Fig. 1). The composition of this alloy lies on the line *ab*, and therefore the alloy consists of a homogeneous solid solution at the ordinary temperature; this is in agreement with the work of Sanfourche,[4] but his diagram does not show whether the α phase is also stable below 500° C. On the other hand, Smith[5] has more recently observed that, in the binary silicon-copper system, the α phase with 5 per cent silicon decomposes below 550° C. into α and γ crystals.

**This article will be continued in an early issue.—Ed.**

[4] Rev. Mét., 1919, 16, 246.
[5] Amer. Inst. Min. Met. Eng., Tech. Publ. No. 142.

# Cupola Melting of Bronze

By E. R. DARBY

Metallurgist, Federal Mogul Corporation, Detroit, Mich.

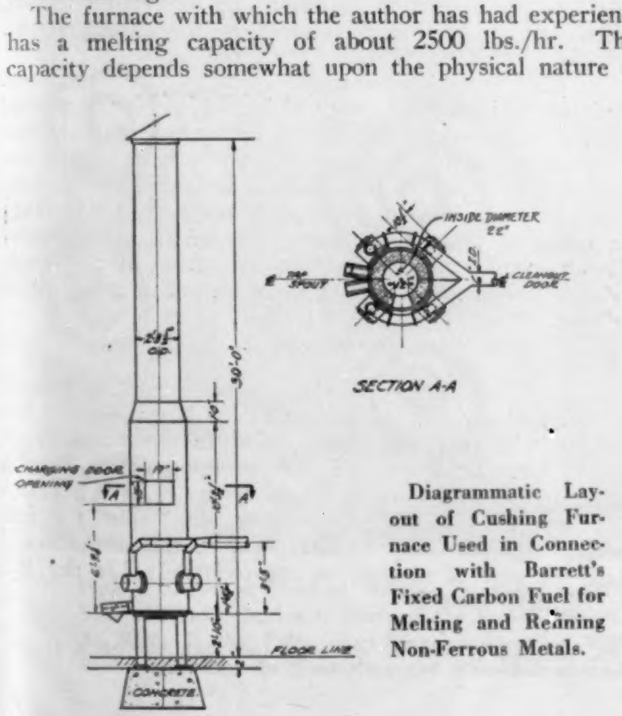
## A Description of the Operation of a New High-Speed Method of Melting Low Zinc, Copper-Base Alloys

FROM METALS AND ALLOYS, NOVEMBER, 1930

ALTHOUGH the cupola or shaft type furnace has for years found general use in the smelting of non-ferrous ores and various secondary materials, its successful application to the melting of bronze for casting purposes is the result of very recent developments. A number of attempts have been made in the past to produce such castings from the usual type iron foundry furnace, but these attempts have in general been unsuccessful because of the character of available fuel and the design of furnace. It was in most instances found very difficult to maintain proper temperature and quality of metal, and as sulphur and other impurities were absorbed, the castings poured were frequently unsound and not fit for use.

With the recent development of pitch coke by the Barrett Co. an exceptionally high grade fuel was made available, which contains practically no ash, very little sulphur and better than 99 per cent fixed carbon. Although the cost of this coke was considerably greater than the usual foundry variety, its high fuel value and remarkable purity were sufficient to throw the balance in its favor. Accordingly a furnace was designed for the express purpose of using this fuel in the melting of bronze and similar alloys, and after thorough and careful trial has now been adopted by a number of large firms making bronze castings.

The furnace with which the author has had experience has a melting capacity of about 2500 lbs./hr. This capacity depends somewhat upon the physical nature of the charge being melted. Very finely divided material such as turnings does not melt as rapidly as material consisting of larger particles such as sprues and cut-up runners. Ingot metal of the usual size, although melting more rapidly than turnings, will not melt quite as readily as the medium size material. However, with the usual charge composed of sprues, runners, turnings and some larger material, the capacity of the furnace should be close to the average figure as mentioned.




**Diagrammatic Layout of Cushing Furnace Used in Connection with Barrett's Fixed Carbon Fuel for Melting and Refining Non-Ferrous Metals.**

By referring to the general plan of the cupola it will be noticed that the inside diameter is 22 in. and the length of the shaft, from the bed plate to the charging door, is 6 ft. 9 in. The openings of the four tuyères are approximately 6 sq. in. in area with their centers 18 in. above the bed plate. Deducting from this 3 in. for the thickness of bottom brick or lining, and the 1½ in. from the center to the bottom of the tuyère opening, the crucible dimensions become 13½ + 22 in. As in operation this space is largely filled with unburned coke, slightly over 500 lbs. of melted metal is all that it will safely accommodate.

The shell of the furnace, slightly over 10 ft. in length, is 3 ft. in diameter and is lined with the usual character of cupola block excepting the first 3 ft. above the bed plate. This section comprising the crucible and melting zone is lined with 4½ in. of silicon carbide brick, backed with 2 in. of insulation. Because of the extreme temperature at and immediately above the tuyères, a lining of silicon carbide material or something of equal refractory properties is necessary. Monolithic linings for this section have been tried in several instances with considerable success, and they have the possible advantage of absence of joints and ease of application.

The bottom door which swings down and backward on a hinge may be permanently lined with firebrick, or after being supported in the closed position may be covered with a layer of loose brick and sand. The latter appears to be the better practice as very frequently a permanent lining is broken in dropping the bottom after a day's melting. The stack shell which is 27 in. in diameter is lined with 2½ in. of ordinary fire brick. This makes the inside diameter 22 in. or exactly the same as the shaft, giving a clear passage for gases without restriction or obstruction of any kind.

The breast of the furnace is arranged for two tap holes made of a special block which may be removed and replaced during operation if necessary. The extra tap hole was thought advisable originally because of the possibility of freeze-up due to slag. However, by always keeping a small amount of metal on the bottom or rather by not drawing at any one tap all the melted metal from the furnace, the danger of slag entering the tap hole is eliminated, and but one hole is necessary. Between the

tuyères and opposite the tap hole, a square opening is provided to facilitate the sealing of the bottom. Before starting the furnace this opening is bricked shut with exception of a small slot slightly below the level of the bottom of the tuyères through which slag may be drawn as it accumulates.

The air delivered to the tuyères is furnished by a belt driven, unloading type blower at a pressure of about ½ oz. A volume ranging between 300 and 400 ft.$^3$/min. has been found most satisfactory, and may be accurately adjusted by means of a gate in the delivery pipe. In operation the pressure and volume gages attached between the tuyères and the blower will be found to vary inversely to a small extent, as the charge in the furnace melts. A fresh charge containing considerable fine particle material

**Battery of Cupola Type Furnaces at Federal Mogul Corporation.**

slightly increases the pressure and decreases the volume of air delivered, but as the charge melts the volume gradually increases and the pressure decreases. This fluctuation is not nearly so marked with charges made of sprues and runners and is almost unnoticeable when ingot metal is used.

Several different methods of charging are in use, depending upon conditions of installation. Charging from a platform is perhaps the most common. If there is sufficient head room the platform may be placed a foot or more above the level of the charging door and the charges dumped by means of a chute directly into the furnace.

When there is not sufficient height to permit of this arrangement, the platform may be below the door and the fuel and metal shoveled into the furnace. A very satisfactory mechanical charger is used by several foundries, where the charges are made up on the floor and the container with both fuel and metal is elevated and emptied into the furnace in a manner similar to that employed with concrete mixers. With a battery of several furnaces in use, the platform above the charging door has the advantage of storage and easy inspection of the condition of the furnace which the mechanical charger does not permit.

One elevator or hoist for the several furnaces is sufficient while with mechanical charging a lift for each furnace would be necessary.

Two methods of operation are in use. With one, the fuel bed is kept at an elevation of about 18 in. above the tuyères and the metal charge, usually about 500 lbs., is allowed to completely melt before another charge is introduced. With the other, the metal and fuel are charged in alternate layers to the level of the charging door and so maintained to the end of the day's run. With the former method it is easier to control analyses particularly when the charge is made of mixed metals with widely varying compositions. The whole charge being melted before another is added assures the desired composition of the liquid metal in the crucible. With the latter method, better efficiency and more rapid melting are possible but it is advisable to keep the components of the charge more nearly alike in composition else the smaller and more rapidly melted particles may greatly vary the analyses of the metal being drawn from the furnace. Where the charge is made up of metals similar in analysis and the melt can be drawn at uniform intervals from the crucible, this method of operation is by far the more desirable of the two.

During the writer's experience with a battery of these furnaces, a number of the well-known bronzes have been melted with, on the whole, remarkable success. The leaded alloys containing up to 10 per cent of that element offer no serious difficulties, and there are installations where bronzes containing as much as 20 per cent lead are successfully handled. However, where so much lead is present it would seem advisable to charge at one time an amount not in excess of what may be tapped into a single ladle.

Alloys containing much over 5 per cent zinc do not appear to be economically handled by this furnace. The loss of zinc is quite heavy as the temperature at or about the tuyères is very high (approx. 3100° F.) and the metal passes through this section of the furnace in very small drops. The 85-5-5-5 bronze will lose over 60 per cent of its zinc content in one melting, and although zinc is one of the inexpensive elements, the actual loss in compositions where this element is of high percentage, may be prohibitive.

The loss of lead at least on alloys containing 10 per cent or under is not serious. It appears to be close to 8 per cent of the amount present although with medium or very low lead contents the 8 per cent figure is probably too great. As in the case with zinc this loss is partially, at least, due to volatilization, for increasing the fuel ratio has little effect upon it.

The losses in copper and tin are almost negligible if the particles of the charge are not sufficiently small to be carried up the stack with the blast. Phosphorus, free iron and free aluminum are almost entirely eliminated, but aluminum and iron in alloy form are not so severely affected.

A phosphorus content as high as 0.15 per cent is almost entirely lost in one melting. However, if a small charge be introduced and melted without air blast the loss in phosphorous may be more than cut in half. From this it would appear that the ultimate action of the furnace is slightly oxidizing in its nature, and that if advantage be taken of this, secondaries containining objectionable elements well up in the electromotive series, may be made to give satisfactory castings when melted in this type of furnace.

**Operating Costs**

Figures for total cost of operation would be difficult to give and perhaps misleading as the labor required for melting will vary widely according to the character of installation. However, it is safe to assume that where a furnace is operated without hold-up for 8 or 9 hours, a fuel ratio of 1 to 14 may be expected. With the fuel costing approximately $35.00 per ton, this ratio would place the cost of melting at approximately 12c per 100 lbs. of metal melted.*

*On December 1, 1930, the price of Barrett pitch coke fell to $25, reducing the fuel cost to 8c per 100 lbs. of metal melted.

# Automatic Zinc Plating and Enameling Pipe

## Continuous Operation Applied to Production of Electro-Galvanized (Zinc Plated) Conduit Pipe at Plant of Steel and Tubes, Inc., Warren, Ohio

MODERN electric light and power transmission involves the use of iron and steel conduit pipe. Hundreds of millions of feet of such pipe is in use today of which approximately sixty to seventy per cent is galvanized externally and enamel-lined, the balance being enameled both inside and outside. The pipe, which runs from ½" to 4½" in diameter and in ten-foot lengths, is subject to rigid specifications and tests of the Board of Fire Underwriters. The galvanized, enamel-lined pipe, for example, must stand the so-called copper sulphate immersion and bending tests as to coating thickness, quality, adhesion and ductility so as to meet the conditions of actual service.

#### Fully Automatic Machine Solves Problem

An installation of Steel & Tubes, Inc., a subsidiary of Republic Steel Corporation, at their Warren, Ohio, plant serves as an example of a modern conduit pipe coating installation which is about as efficient as conceivably possible. This concern has installed what is believed to be the largest automatic cleaning, plating, enameling and baking machine in the world. It is 207 feet long and fifteen feet wide, completely automatic, operated under the supervision of one man, and capable of producing each minute ten lengths, or 100 feet, of conduit pipe, fully galvanized by electro-deposition of zinc on the outside, and having a baked enameled coating on the inside. Operating a double shift, a day's output is 142,000 feet, and the annual production of this machine is expected to reach 42,600,000 feet. The apparatus was designed, constructed and installed by the U. S. Galvanizing & Plating Equipment Corporation, Brooklyn, N. Y.

#### Operations of the Machine

Steel & Tubes, Inc., operate at Warren, Ohio, a most modern plant for the production of electrically welded conduit, where every known method that would produce a superior product at a minimum production cost has

**Fig. 1—Conduit Pipe Finishing Installation at Plant of Steel and Tubes, Inc., Warren, Ohio.**

**Pipe Is Shown at Head of Machine, in Foreground, Ready for Processing. Conveyor Mechanism Running Over Line of Tanks Carries it Through the Various Stages. The Sprockets Lift the Pipes from One Tank to the Next. At Right Is the Fully Glass-Enclosed Electrical Equipment for Generating 30,000 Amperes. In Extreme Left Background Are the Enameling and Baking Sections, in Direct Line with the Cleaning, Galvanizing and Drying Sections.**

been incorporated. At this plant the bulk of the production is ½", ¾" and 1" conduit, and the automatic machine for treating the pipe has accordingly been arranged for these sizes. The machine is so designed that no adjustment whatever is required when changing from one size to another; in fact, all three sizes may be run at the same time.

In view of the design and general flexibility of this type of construction, it is obvious that such an automatic machine may be arranged for any required diameter pipe, processing treatment, sequence and time cycles, according to the character of pipe to be treated, as, for instance, for steel tubes, hot rolled iron pipe, etc. In fact, it is entirely feasible to build such equipment so as to handle conduit pipe of different basic materials, such as iron and steel, in the same automatic machine. The machine consists of a series of tanks each twelve feet wide, of various lengths, placed end to end, over which a conveyor system has been arranged, and which is connected in direct line with an enameling coating unit and a baking oven. The pipes move along the machine horizontally at all times, the only variation from this position being slight tilting at one end at certain points along the route, to aid in draining. Pipe is piled on a rack at the head of the machine, where an automatic feed picks up the pipes individually and sends them through the complete cleaning, plating, enameling and baking processes without further handling.

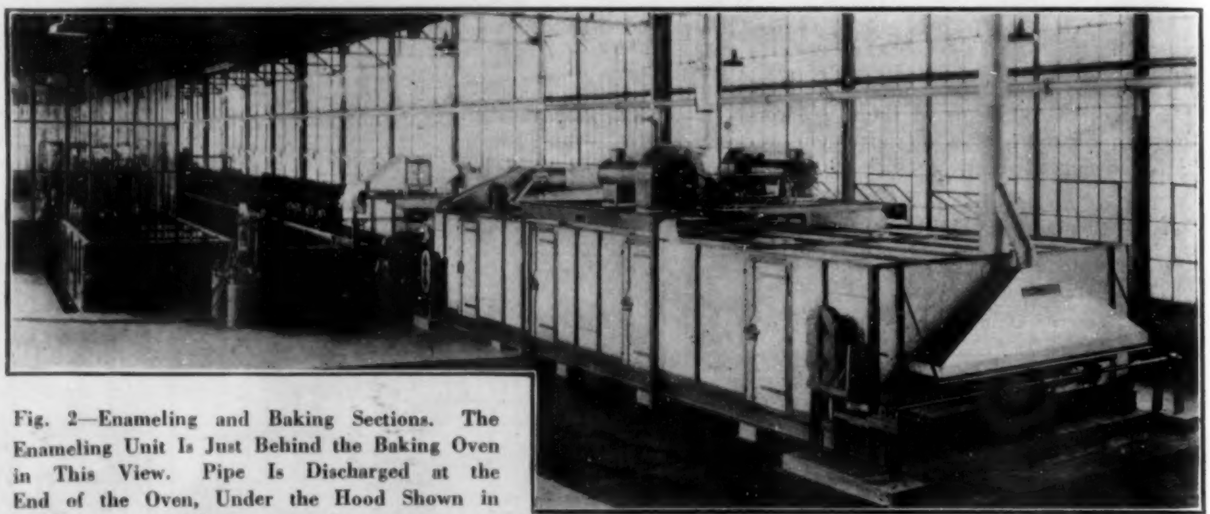


**Fig. 2—Enameling and Baking Sections. The Enameling Unit Is Just Behind the Baking Oven in This View. Pipe Is Discharged at the End of the Oven, Under the Hood Shown in Right Foreground.**

The specially designed conveyor system is made up of materials suitable for the work with respect to being acid and corrosion-proof at those points where acids and strong alkaline solutions are used. It has sprockets or spider pick-ups which lift the pipe from the tank and immerse it in the following tank, as well as pushers that aid in conveying the pipe. These parts are made of steel, special non-plating composition material, and acid-resisting metals, depending upon what solutions they must withstand. The tanks throughout are made of steel; they are rubber lined where the nature of the solution necessitates added protection, as in the pickle, acid dip, galvanizing and rinse tanks.

The various solution temperatures are regulated by thermostatic control. Motion or agitation throughout the various pickling, cleaning and rinsing solutions is provided, which not only accelerates their action, but permits reduction in acid and alkali solution concentration. The zinc sulphate solution in which the pipe receives the final heavy coating of zinc has a capacity of 9,600 gallons. In addition there is an auxiliary tank of the same solution composition, of a capacity of 5,000 gallons, which is piped to the main galvanizing tank and is provided with a filter and motor driven pump for circulation in order to maintain maximum galvanizing solution efficiency with minimum attention. The main bath is changed and filtered automatically every two hours without interruption in production or equipment adjustments of any kind.

The machine's 17 operations are as follows:

1. Automatic feed and alkali soak.
2. Rinse and spray.
3. Alkaline electrolytic cleaner.
4. Rinse and spray.
5. Acid pickle.
6. Acid dip.

7-8. Double rinse and spray.

9. Zinc cyanide "strike" solution.

10-11. Double rinse and spray.

12. Zinc Sulphate "finish" solution.

13-14. Double rinse and spray.

15. Air blast through pipe and dry.
16. Enameling.
17. Baking and discharge.

#### Electrical Apparatus.

The installation includes generators capable of producing 30,000 amperes. This is provided by motor-generator sets which are all housed in a glass enclosure at one side of the room in which the machine is located. The glass enclosure prevents injury to the electrical apparatus from acid fumes, dust or dampness.

Operation of the entire installation is driven by only one motor of 5 horsepower.

#### Operations Performed by Machine

The component operations of cleaning, pickling, rinsing, galvanizing, enameling and baking combined in the machine are completely continuous, so that each length of pipe is in motion throughout the processing treatment. The different treatment cycles have been predetermined and synchronized as a whole. The pipe is supported along the bottom of the tanks on a series of rails or tracks, which are made of copper in the plating baths so as to simultaneously supply the negative current to the work. These rails or tracks converge from both sides

of the tanks. Convergence of these tracks provides a constantly changing point of electrical contact so that each length of pipe is uniformly exposed to the electrolytic action. The anodes or electrodes are disposed underneath the pipe, being simply laid on suitable supporting positive copper current conductors. These anode conductors are lead sleeved.

The rough pipe is placed in bulk, horizontally on a rack at the head of the machine and is held in a substantially horizontal position throughout its treatment. The spider wheels and conveyors, over the series of tanks, pick off the individual lengths of pipe and convey them from tank to tank, through the dryer, to the enameling section and finally through the enamel baking oven, from which it is automatically discharged. At the outset the pipe first enters and is conveyed through an alkali soaking bath. Upon reaching the opposite end the pipe is lifted from this tank, drained and carried into a rinse, thence into an alkaline electrolytic solution. After another rinse, the pipe is submerged in an acid pickling solution.

As previously mentioned the solutions are all forced through the pipes by means of an agitating action, which speeds up the work and increases efficiency of the solutions. After the acid pickling comes the acid dip, followed by a double rinse, which removes the acid used to clean the pipe. They then enter the zinc cyanide "strike" solution, where the pipe gets its first coating of zinc. It is then double rinsed again, and immersed in the zinc sulphate "finishing" solution, where it receives a heavy coating of zinc. After this another double rinse is employed, then an air blast automatically blows through the pipe to facilitate drying, after which it is sent through the drying section of the machine. It is now thoroughly galvanized on the outside, and ready for enameling on the inside, which the enameling section proceeds to do.

#### Enameling by a Unique Method

As the pipes emerge from the dryer they travel down a slight incline, accumulating in groups of five, the first pipe when leaving the dryer contacting with a starting lever of the enamel unit, which automatically starts it operating. The pipe is enameled on the inside by an ingenious arrangement of spray nozzles in combination with a rotating pipe-holding rack, or carrier, capable of supporting and treating five pipes simultaneously. The rotation of the pipe carrier having been started, it picks up five lengths, when rotation ceases and carrier moves sidewise, telescoping the pipes over the enamel spray nozzles. With the nozzles inserted to the full length of the pipe, the carrier automatically reverses its direction of travel and as the nozzles are withdrawn, the interiors of the pipes are sprayed with an elastic enamel lining.

Various safety features have been incorporated, such as limiting the enamel spraying action to the number of pipes actually in the carrier. Should there be, for instance, only four instead of the usual five pipes in the carrier, the particular nozzle for this absent pipe will be shut off automatically and the balance of the nozzles will function as usual. Again, should by any chance a pipe fail to be properly aligned for entry of the spray nozzle, due to being badly bent or for other reasons, an automatic switch stops operation of the enameling unit without interrupting operation of the balance of the machine. While the spray nozzles have been designed to avoid clogging due to drying of enamel, should this occur, as for instance when operation has been suspended over a week-end, the nozzles may be simultaneously and quickly cleaned by shutting off the enamel and shifting a lever which transfers the feed from the enamel tanks to a gasoline supply, which forces a gasoline spray through the nozzles.

#### Baking Arrangement

Enamel spraying completed, the galvanized and enamel-lined pipes are automatically discharged from the enameling unit and conveyed into the baking oven. It is of special design and provided with suction fans to constantly circulate hot air around and through each length of pipe during its travel through the oven. The conveyor system in this oven consists of three sets of conveyors moving in horizontal planes, the pipes automatically traveling from one plane to another until they leave the oven at the discharge point. It is so designed that during a portion of the travel of the pipe through the oven it is rolled in order to maintain absolutely uniform distribution of the enamel coating while setting, after which it is conveyed without rolling to prevent possible marring of the galvanized surface.

Although the baking operation is of much longer duration than most of the other operations on the machine, the pipes are sent into the oven steadily because of synchronization of the entire process, and they emerge in like manner at the rate of ten lengths per minute, ready for inspection, labeling and shipment.

#### Motion Picture Shows Machine in Operation

Since an automatic machine of this nature has so many different features which are important and essential to its successful operation and which can be readily overlooked during inspection of an installation, the builders, in collaboration with the company which operates it, have produced a very complete 16 m.m. motion picture film which gives an excellent view of the entire machine in all its details, and clearly brings out all these points, including the thorough slushing of the pipe, draining means, pipe alignment, enamel lining of the pipe, setting of enamel in oven, etc.

The picture, in most respects, leaves a clearer impression of the operation of the machine than perhaps could be obtained even from an actual view of it in operation at the plant.

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## Gold on Church Work

Q.—What solution would you recommend for gold plating church work? We would like to prepare an 8-gallon solution. Can you give approximate costs of the materials and equipment?

A.—To prepare an 8-gallon fine gold solution for the class of work that you intend to do, it will require the following chemicals:

| | |
|---|---|
| Gold cyanide | 4 oz. |
| Sodium cyanide | 8 oz. |
| Sodium phosphate | 8 oz. |
| Water | 8 gallons |

Temperature at which the solution should be operated, 140° F.; 2 volts current.

Fine gold anodes should be used; this is the most costly item in the installation of a gold solution. The price of the anodes will vary, depending upon the size and weight of the anode. A rolled gold anode 4 inches by 2 inches by 1/16 inch thick will weigh approximately 2½ ozs., troy, and will cost about $50. As it will be necessary to have at least 2 anodes, they will cost about $100. The gold cyanide and the other chemicals will cost about $50, so the complete cost of the outfit would be about $250.

OLIVER J. SIZELOVE.

# Electrodepositing Lead-Thallium Alloys

By COLIN G. FINK and CLARENCE K. CONRAD, JR.

Head, Division of Electrochemistry, Columbia University and Graduate Student, Columbia University, Respectively

## Experiments in the Use of These Extremely Insoluble Alloys for Electroplating—Co-Deposition of the Two Metals Investigated—Smooth, Adherent Deposits Obtained in a Perchlorate Bath.

PAPER READ AT FIFTY-EIGHTH GENERAL MEETING OF THE AMERICAN ELECTROCHEMICAL SOCIETY, AT DETROIT, MICH., SEPTEMBER 25, 26, 27, 1930.

THE corrosion resistance of the lead-thallium alloys was investigated ten years ago[1] and, within the range of about 20 to 65 per cent thallium, the alloys were found to be among the most insoluble alloys known. Uses for insoluble alloys are numerous, but the high price of thallium prevents general application.

However, if an electroplate can be obtained readily of proper composition and character, it would provide a very acid-resistant surface to iron, steel, brass, etc., and as such might also be used as an insoluble anode in electro-winning.

Accordingly, the present investigation was undertaken on the electrodeposition of the lead-thallium alloy.

It was found that successful plates of the alloy of 70 per cent lead (the most economical alloy in the most insoluble range) could be obtained with a high ratio of $Tl^{+}/Pb^{++}$ in the bath, using the perchlorate solution, low metal concentrations and low current densities.

From a study of the literature concerning the deposition of each individual metal, it was decided to use the perchlorate bath. It has been successfully used to plate thallium,[2] and it offers several advantages with lead. It is readily prepared, the metal salts are very soluble, and it is stable, easily analyzed and a good conductor.

### Preparation of Baths

The baths were prepared by making up solutions of Pb $(ClO_4)_2$ and Tl $(ClO_4)$ and mixing as required. Perchloric acid, $HClO_4$, was prepared according to the method of Frank C. Mathers.[3] Solid, dry, $NaClO_4$ is covered with about the same weight of concentrated hydrochloric acid, stirred, and filtered through asbestos. The filtrate is heated on the hot plate to 135° C., at which temperature all of the excess hydrochloric acid is volatilized, with only slight loss of perchloric acid. This results in a stable, easily handled solution of about 70 per cent perchloric acid containing very little chloride.

To prepare Tl $(ClO_4)$, the method described by Brown and McGlynn was tried, but resulted in such a low yield that it was abandoned. After a number of different trials we finally proceeded as follows: Thallium metal (A. S. and R., Denver grade) was flaked and dissolved directly in an equivalent amount of pure perchloric acid. The Pb $(ClO_4)_2$ solution was obtained by dissolving litharge in an equivalent amount of $HClO_4$. The slight excess of acid present was not driven off by evaporation to dryness, but was taken into account in the analyses.

[1] Electrolytic Corrosion of Lead-Thallium Alloys, Fink and Eldridge, Trans. Am. Electrochem. Soc., **40**, 51 (1921).

[2] Electrodeposition of Thallium. O. W. Brown and Sister Amata McGlynn. Trans. Am. Electrochem. Soc., **53**, 351 (1928).

[3] Trans. Am. Electrochem. Soc., **21**, 331 (1912).

[4] G. A. Roush, Trans. Am. Electrochem. Soc., **56**, 387, 389 (1929).

### Analysis of Baths

Thallium was determined gravimetrically by precipitation as the iodide, and lead gravimetrically as the sulfate. Free acid was titrated with standard NaOH solution. In order to prevent interference, the following procedure was used to analyze a bath containing both metals:

One cc. of $N$ $H_2SO_4$ is exactly neutralized with NaOH solution to give a neutral solution of $Na_2SO_4$. A 2-cc. sample of the bath to be analyzed is then added, and the resulting lead sulfate precipitate is filtered into a Gooch crucible and weighed. The filtrate is titrated for free acid, then potassium iodide solution is added, and the thallium iodide precipitate is filtered into a Gooch crucible and weighed. Free acid cannot be titrated until lead is removed.

### Analysis of Deposits

Since both lead and thallium can be deposited with practically 100 per cent cathode current efficiency when using the perchlorate bath, and since the electrochemical equivalent of thallium is approximately twice that of lead ($Tl^{+}$ = 7.62518; $Pb^{++}$ = 3.86538 g./amp. hr.),[4] the weight of the deposit can be used to calculate the percentage composition, if a coulometer is used in series with the plating cell. That is, for any given deposit, whose weight is intermediate between the weights of a pure lead and a pure thallium deposit for the same number of coulombs, there is one definite percentage composition.

Let $a$ = weight of a thallium deposit.
$b$ = weight of alloy deposit.
$x$ = No. of Faradays to deposit an equivalent weight of lead.

The deposit is weighed as $b$, and from the coulometer $a$ is calculated. At first a copper coulometer and later a lead coulometer was used, to provide this value $a$. The lead coulometer consisted of a bath of 50 g./L. Pb $(ClO_4)_2$, 10 g./L. free $HClO_4$, with lead anode and brass cathode, using about 8 amp./sq. ft. (0.864 amp./sq. dm.) cathode current density. It gave results in very close agreement with, and of a slightly higher value than, those of the copper coulometer.

### Experimental

Two or three cells were run in series with the coulometer, in preliminary runs, and only one at a time later on. All solutions were vigorously stirred excepting that in the coulometer. Brass cathodes were used throughout.

First, lead and thallium deposition was tried alone.

There was much more difficulty in obtaining a good thallium plate than a good lead plate. The ease of obtaining a good alloy plate increases with the percentage of lead deposited. The anode polarization of thallium became very high and, although several attempts to prevent this were made, the only satisfactory scheme was the use of rather low metal concentrations. Adding $HNO_3$ to counteract anode "passivity" had practically no effect on the voltage. The pH was varied, and it was found that temporary depolarization could be brought about by lowering the acid concentration. With lead, on the other hand, good plates were obtainable over a wide range of conditions.

### Effect of Concentration Ratio

With the solution potentials of the two metals not very far apart, the higher valence of lead should necessitate the deposition of two lead ions for every monovalent thallium ion to produce an alloy deposit containing 50 per cent of each metal. On this basis a bath consisting of 40 g./L. lead and 20 g./L. thallium was first tried, and resulted in a 100 per cent lead plate.

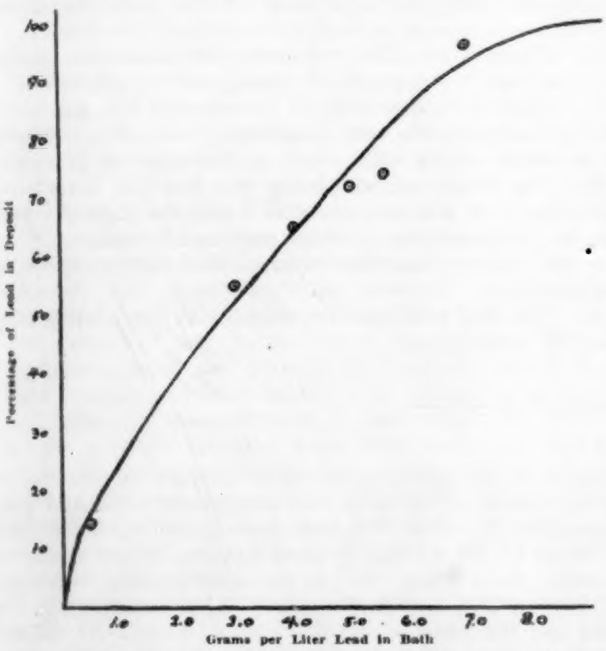


**Fig. 1. Curve showing variation of percentage composition with concentration ratio in bath. Concentration of thallium, 30 grams per liter.**

Then a solution containing 20 g./L. of each metal was tried, and again resulted in a 100 per cent lead plate.

The ratio of the next bath was Tl/Pb = 2 (36 g./L.: 18 g./L.) and again 100 per cent lead deposition occurred.

From these experiments it was obvious that a high ratio of thallium to lead is necessary to co-deposit the two metals.

A ratio of 86 g./L. thallium to 10 g./L. lead was therefore tried, and gave a deposit of less than 10 per cent thallium. Thallium anode polarization was high, rising to 5 volts in less than a minute with a current density of 10 amp./sq. ft. (1.08 amp./sq. dm.)

A bath consisting of 40 g./L. thallium and 5 g./L. lead was used in the next experiment, and very little anode passivity was observed for thallium. The plate was 62 per cent lead, 38 per cent thallium.

Following this a series of runs was made with conditions close to the last, and the ratio Tl/Pb was varied

TABLE I. ELECTRODEPOSITION OF LEAD AND THALLIUM

Concentration of thallium = 30 g./L. Free acid: 20-30 g./L. Current density: 5 amp./sq. ft. (0.54 amp./sq. dm.). Temperature: Room. All solutions were stirred.

| g./L. Lead | Per Cent Lead in Plate | Time of Run min. | Remarks |
|---|---|---|---|
| 0.5 | 14.0 | 16 | Plate poor, trees. |
| 3.0 | 55.0 | 45 | Trees appeared after 30 minutes. |
| 4.0 | 65.0 | 17 | Good plate, no trees. |
| 5.0 | 72.0 | 21 | Very good plates, fine grains. |
| 5.6 | 74.0 | 46 | Very good plate, fine grains. |
| 7.0 | 96.0 | 32 | Very good plate, fine grains. |

to give deposits of different percentage composition. These runs are recorded in Table I and illustrated in Fig. 1.

The results shown in Table I prove the possibility of controlling the percentage composition of the plate by close regulation of the concentration ratio of the metals. The results also demonstrate that the electrodeposits improve with the percentage of lead because from a chlorate bath good deposition of thallium is much more difficult than of lead.

### Effect of Current Density

It was necessary to use low current densities to obtain a fine-grained 100 per cent thallium deposit and, consequently, we could not vary the current density beyond narrow limits, in order to control the percentage composition of the alloy plate.

### Effect of Concentration

As has been stated above, at the higher concentrations of thallium, anode polarization became excessive and poor cathode deposits resulted. Accordingly, our experiments were confined to comparatively low thallium metal concentrations in the plating bath.

### Discussion of Results

According to the electromotive series, lead is more noble than thallium, and, therefore, we might expect a comparatively high thallium metal concentration, or high $Tl^{+}/Pb^{++}$ ratio, in order to obtain a cathode deposit composed of equal quantities of each metal. On the other hand, one coulomb of electricity will deposit approximately twice as much $Tl^{+}$ as $Pb^{++}$ (2.11811 mg. and 1.07372 mg., respectively). The thallous salts in solution are more stable than the thallic salts, whereas in the case of lead salts the reverse holds true. The solubility of lead perchlorate is about ten times that of thallium perchlorate. The absolute migration velocity (at 18° C. and 1 volt per cm.) is 0.000684 for the thallous ion $Tl^{+}$ and about 22 per cent less for the plumbic ion, $Pb^{++}$. Comparing these and other physical and physicochemical properties of the two metals in solution, it is not possible to account satisfactorily for the behavior of the two metal ions during co-deposition.

### Conclusion

A good, adherent alloy plate of fine grain, composed of about 70 per cent lead and 30 per cent thallium (the cheapest percentage composition in the range of the most insoluble alloys of the two metals) is obtainable with the perchlorate solution, 30 g./L. thallium, 5 g./L. lead, 20 to 30 g./L. of free acid, and a current density of 5 amp./sq. ft. (0.54 amp./sq. dm.) at 25° C.

The percentage composition of the cathode deposit is readily controlled, by regulating the metal ion ratio $Tl^{+}/Pb^{++}$.

# The Deposition of Nickel at a Low pH

**By A. KENNETH GRAHAM**

**An abstract from a paper by C. H. Mougey and W. M. Phillips, in the Monthly Review of the American Electroplaters' Society, September, 1930.**

THE authors have found that by operating a nickel solution of the Watts type at high temperatures

**Solution Composition**

| | |
|---|---|
| Single Nickel Salts | 32-40 oz. |
| Boric Acid | 3 oz. |
| Nickel chloride | 3 oz. |

and a pH of 1 to 2.5 rather than the customary range of 5.6-6.0, current densities well over 100 amperes per square foot may be used and still produce very satisfactory deposits.

While considerable trouble is experienced with pitting at first, the bath improves with use and provided the pH is kept below 3.0, no greater pitting will be experienced than would be the case with the ordinary hot nickel at a higher pH value (5.8).

Even though the cathode efficiency drops to 70 per cent at a pH of 1.0, the use of higher current densities permits more rapid deposition and the wider plating range gives deposits less subject to cracking and roughness at the edges.

The advantages claimed by the authors are as follows:

1. Increased plating range.

It is possible to use a higher current density without peeling or cracking at the edges with heavy deposits.

Decreased time due to the use of higher current densities.

2. Better anode corrosion.
3. No turbidity in bath if pH is kept under 3.0.
4. Metal is supplied to the solution from anodes instead of by additions of nickel salts.

The disadvantages are:

1. There is a greater initial tendency for a low pH bath to cause pitting.
2. Lower cathode efficiency—as low as 70 per cent at pH 1.0.
3. Too high anode corrosion under some conditions. Insoluble lead anodes are then substituted for some of the nickel.
4. Trouble will result if the pH is allowed to become high (since the pH can vary from 1.0 to 2.5 without greatly affecting the operation of the bath the above limitation is not so serious.)
5. There is a tendency for the pH to increase gradually, making it more difficult to control the pH values.
6. Since it is desirable to operate the low pH baths at high temperatures, the tanks and linings are restricted to materials which will permit such temperatures.
7. For bright nickel plating the low pH bath gives best results at low temperatures while the high pH bath can be operated over a wider temperature range. (The low pH bath is therefore better suited for heavy nickel deposits.)
8. The low pH bath is not suitable for plating zinc base die castings.

## Cleaning Silver Alloy

**By WILLIAM J. PETTIS**

Q.—We are inclosing a small sample of an alloy which contains 10% pure silver, 40% spelter, and 50% copper, which we are having trouble cleaning after the annealing operation.

This metal is in coils of the thickness shown by the sample. We will be glad to have you tell us what we can use to clean the surface without disintegrating the metal.

A.—We do not know of any acid that will remove the red oxide and other deposits from the samples submitted except a bright dip composed of muriatic and nitric acids. But this would be impractical for application to this class of work.

With no knowledge of your process and only the sample to judge by, we would say the trouble lies in the annealing of the metal; a condition of furnace atmosphere that makes a deposit not soluble in sulphuric acid. This can be caused by lack of sufficient oxygen in the furnace chamber, or the coil of metal not being opened sufficiently to allow combustion of the film of oil left on the metal from the rolling process. The heat reduces the oil to a carbon deposit that is not soluble in the sulphuric acid bath.

Without sufficient oxygen in the annealing chamber an oxide similar to the cuprous oxide is produced in the annealing of copper sheets under these conditions. It consists of two parts copper and one part oxygen. This is not soluble in the acid bath and leaves a red and grey deposit on the sheet that tarnishes rapidly when the sheet is cleaned. By admitting more oxygen to the annealing chamber the oxide formed on the sheet contains two parts of oxygen and one part copper. This is soluble in the bath and "pickles" easily.

The sample submitted to me was cut in two; one-half was annealed in a furnace in which the air was admitted through open ports, and then pickled in the regular sulphuric acid bath. This broke up the deposit and cleaned readily. The other half was not touched, except to try to pickle it. This was not successful.

If bright annealing is attempted the coil must first be free from oil.

## Protecting Nickel Plate

Q.—Will you kindly advise us what we may use on nickel plated copper coffee urns to preserve the nickel?

A.—We presume from your inquiry that the nickel plated finish on the coffee urns tarnishes or becomes dull while in stock. To prevent the tarnish, we suggest that they be wrapped in wax paper. Or else, apply a thin coating of wax or oil which can be readily removed with gasoline or turpentine. Ordinary floor wax might prove satisfactory; paraffine oil can also be used.

OLIVER J. SIZELOVE

# Buffer Action in Nickel Plating Solutions

By DR. K. PITSCHNER

Chief Chemist, Firestone Steel Products Company, Akron, Ohio

## The Resistance to Change in pH Exhibited by a Solution When It Is Subjected to Gain or Loss of Acid or Alkali. This Action Varies Greatly at Different pH Values.

FROM THE MONTHLY REVIEW OF THE AMERICAN ELECTROPLATERS' SOCIETY, FEBRUARY, 1931

CONTROL of hydrogen on concentration in operation of nickel plating baths has been recognized to be of prime importance for several years. With the usual solutions operated under ordinary conditions, satisfactory deposits are obtained through a very narrow range of pH the limits of which are approximately 5.0 to 5.5, measured electometrically.

In order to maintain the pH within these close limits, the careful plater finds it necessary to make frequent determinations either colorimetrically or with the quinhydrone electrode. From the information thus gained he is enabled to detect unfavorable trends in the operating qualities of the solution and make additions of acid or alkali which will forestall probable trouble later on.

It has been found that certain reagents, which are now common constituents in nickel plating solutions, have the property of depressing the tendency towards large changes in pH, thus simplifying control of the important factor. Chief among these reagents are boric hydrofluoric, citric and tartaric acids which belong to the class known as weak acids. The extent to which the hydrogen ion concentration is controlled by these reagents depends on their concentration. This property, known as buffer action, has been defined by W. M. Clark as the resistance to change of pH exhibited by a solution when it is subjected to gain or loss of acid or alkali. The extent to which this action takes place varies greatly at different pH values.

An investigation carried on by Wm. Baulieu and myself in the laboratory of the Bridgeport Brass Company indicates that common constituents of nickel baths other than weak acids exert a very marked effect on the extent of buffer action. The study was confined to solutions of the compositions shown in the table. The extent of buffer action is evaluated by the method described by Van Slyke. It is the differential ratio of the increment in gram equivalents of strong acid or base added per liter of the solution to the resultant increment or change of pH. Under this definition a solution has a buffer action of 1 unit when a liter of solution requires one gram equivalent of strong acid or base to produce a unit change in pH.

All measurements of pH in the course of the investigation were made electrometrically using the quinhydrone and saturated calomel electrodes in conjunction with a potentiometer, standardized against M/20 acid postassium phthalate. The data for each of the above solutions was obtained on duplicate 100 c.c. samples as follows:

1st: The pH was adjusted to above 6.0 by addition of ammonium hydroxide and stirring until the precipitate of nickel hydroxide was dissolved.

2nd: The samples were titrated with dilute sulphuric acid containing 10 per cent by volume of acid, 1.835 specific gravity. Acid of this strength was used in order to prevent excessive dilution of the sample during the course of the titration as well as to simplify calculations. A drop titration method was used in all runs because of the small volume of titrating reagent involved. The drop volume was carefully determined for the burette and titrating solution and found to be .0435 c.c. The pH was measured at sufficiently frequent intervals to give smooth, reliable curves.

3rd: Curves of pH versus acid additions were drawn from this data.

4th: The values for buffer effect in the table were determined from the slope of the curves at intervals of .5 from 6.0 pH to 2.5 pH. It was found that this method gave a better approximation than the use of increments of acid and pH because of the rapidly changing buffer action at certain points on the curves.

The data in the table shows the following:

1. That buffer effect is highest at the upper end of the pH range—reaching its maximum at the pH where nickel hydroxide begins to precipitate out.
2. That the buffer effect is least in the vicinity of pH 4.0, being only 1/20th to 1/100th of the value at pH 6.
3. That the pH again increases rapidly near the lower end of the scale, being about ten times the value at pH

TABLE

| Run No. | 2 | 4 | 6 | 9 | 10 | 13 | 15 |
|---|---|---|---|---|---|---|---|
| NICKEL CONTENT: | | | | | | | |
| gm/L | 30 | 30 | 30 | 30 | 30 | 60 | 30 |
| oz.gal. | 4 | 4 | 4 | 4 | 4 | 8 | 4 |
| BORIC ACID: | | | | | | | |
| gm/L | 0 | 7.5 | 15 | 22.5 | 30 | 15 | 15 |
| oz.gal. | 0 | 1 | 2 | 3 | 4 | 2 | 2 |
| AMMONIUM CHLORIDE: | | | | | | | |
| gm/L | 15 | 15 | 15 | 15 | 15 | 15 | 30 |
| oz.gal. | 2 | 2 | 2 | 2 | 2 | 2 | 4 |
| VAN SLYKE UNITS: | | | | | | | |
| at pH 6.0 | .0464 | .0687 | .1240 | .1545 | .1545 | .2429 | .1548 |
| at pH 5.5 | .0231 | .0231 | .0260 | .0334 | .0451 | .0740 | .0742 |
| at pH 5.0 | .0068 | .0074 | .0079 | .0100 | .0126 | .0284 | .0226 |
| at pH 5.5 | .0024 | .0030 | .0026 | .0044 | .0049 | .0066 | .0057 |
| at pH 4.0 | .0021 | .0017 | .0028 | .0014 | .0024 | .0033 | .0027 |
| at pH 3.5 | .0040 | .0046 | .0046 | .0041 | .0038 | .0040 | .0035 |
| at pH 3.0 | .0071 | .0082 | .0084 | .0102 | .0076 | .0086 | .0076 |
| at pH 2.5 | .0309 | .0300 | .0310 | .0340 | .0475 | .0834 | .0208 |
| CC. of $H_2SO_4$ 1.835 sp. gr. to change 100 gal. of Sol. from 6.0 to 5.0 pH | 274 | 298 | 345 | 452 | 573 | 945 | 704 |

2.5 that it is at the low point around pH 4. This is probably one of the contributing factors in the successful nickel plating around pH 2 which was described by W. M. Phillips at the Rochester meeting.

4. In the usual plating range of pH 6 to 5 the buffer effect is more noticeable when alkali is added than when acid is added, while in the lower range mentioned before the reverse is the case.

5. That buffer effect is about three times as great at pH 5.5 as at pH 5.

6. Below pH 4, boric acid has little buffer effect in quantities up to 4 ounces per gallon. At pH 5.5 the presence of 4 oz. per gallon doubles the buffer effect as compared with solutions with no boric acid present. At pH 6 the buffer effect is about 3½ times that when no boric acid is present.

7. Increasing nickel sulphate concentration markedly increases buffer effect above pH 4. In comparing Runs No. 6 and No. 15, which used the same solution composition except for nickel content, it will be noted that doubling the nickel content has increased the effect to about four times the value at pH 5, three times at pH 5.5 and two times at pH 6.

8. Increasing ammonium chloride concentration increases the buffer effect considerably, above pH 4, as shown by comparison of Runs No. 6 and No. 13, which have the same solution composition except for ammonium chloride content.

9. It is probable that any considerable quantities of soluble salts will have the same effect on buffer action that nickel sulphate and ammonium chloride show.

A slight modification of the method of procedure employed in this work was found to be well adapted to regulating the pH of nickel baths in constant service. The titration is made as follows:

100 c.c. of the nickel solution is pipetted out and sufficient quinhydrone added to saturate it. The salt bridge of the calomel electrode and the platinum indicator electrode are immersed in the nickel solution and the pH read by means of the potentiometer. If the value found does not coincide with the desired pH value, the potentiometer dial is set to the millivoltage corresponding to the desired pH. The standard acid is then added drop by drop; the drops being counted until the galvanometer needle registers zero. From the number of drops of 10 per cent (by volume) acid used, the strong acid needed to lower the pH to the desired value is calculated as follows:

c.c. strong acid required: drops 10 per cent acid X drop Vol. X Sol.

Vol. in Liters.

: drops 10 per cent acid X drop Vol. X Sol.

Vol. X 3.785 in Gal.

From this equation a factor may be worked out for each bottle under control.

It was found that by this method a single addition of acid would regularly bring the pH of the various solutions to within .05 of the desired value, thus eliminating the cut and try method commonly used in making additions. The actual determination requires less than five minutes.

It has been our practice to hold the ammonium chloride content of nickel solutions sufficiently high so that the anode corrosion will keep the trend of pH towards the upper limit of the range and so that additions of acid only are necessary, thus simplifying control.

Dr. Wm. Blum: Mr. Chairman, I would like to start something. The whole subject this morning is on the control of nickel solutions, and it is hard to discuss one part of it without anticipating some of the things coming on later, but I think that is worth while just to see how involved the question is. After all, these facts that Mr. Pitschner has brought out are just the things that we need to enable us to make predictions and get satisfactory methods of control. On the other hand, there are so many other conditions such as will be brought out by Mr. Phillips and Mr. Mougey that we can't reach a single conclusion and say, "That's that." I want to call attention to one point here which is frankly a surprise to me. If anybody had asked me whether if you had a solution, a strong nickel solution, with eight ounces per gallon you should have more boric acid, I would say "Yes," because it seems natural if you have a stronger nickel solution to put more boric acid in. You are putting it in for buffer action. Actually, these results show that increasing your nickel content has more effect than the boric acid; therefore, the more nickel you put in, the less boric you need. If you take a solution with four ounces of nickel, it would be better to run your boric acid up to four ounces per gallon to get a good buffer action. On the other hand, if you have a high nickel content, you don't need the boric acid because the nickel sulphate itself is serving as a buffer there.

So you see how facts change our opinions. In other words, I simply assumed, as I suppose most people would, that the stronger the nickel solution,—say if you had a high nickel content, say eight ounces per gallon, you should put in six ounces of boric acid, especially in a warm solution; whereas this shows the effect is quite different from what we would expect.

And in the same way you see that increase in the content of ammonium chloride makes a difference. Now it would be interesting to know whether that difference was due to chloride; in other words, whether you got it just the same whether you added ammonium chloride or sodium chloride or nickel chloride, or whether it is due to the ammonium content. I think it is due to the ammonium, for the reason that your nickel sulphate or ammonium chloride or acid salts seem to hydrolize and liberate acid which tends to give them a buffer action.

Then there is another thing which is anticipating somewhat what Mr. Phillips and Mr. Mougey will say, and that is that all this buffer action is down the bottom here, around, as Mr. Pitschner has said, it is best around pH 5 to 6. Now then, if you are working at from 2 to 4, why these figures, interesting as they are, don't help you very much. They simply show that it doesn't make much difference what composition of solution you have, that you are going to have very little buffer action if you are working at a low pH, that is, around 2 to 4; although, as Mr. Pitschner pointed out, it does shade off again when you get down to a very low pH. So it may be there are two ranges of nickel deposition that are good, and in between is rotten, because you have no buffer action. Now those are just suggestions, but it shows how complicated the situation is.

Dr. A. K. Graham: I would like to ask a question to clear up a point. You have stated, Mr. Pitschner, that you varied the ammonium chloride from 2 to 4 ounces per gallon and that the nickel content was four ounces. In a solution where you have four ounces of metal, and your ammonium chloride would be four ounces, you would have a saturation of the double salt. Did you note whether your metal content fell off due to precipitation under those conditions?

Mr. Pitschner: I don't believe there was any precipitation at that point. I believe Mr. Baulieu will check me on that. We didn't notice any precipitation at that point.

# Annual Open Meeting of the New York Platers

THE New York Branch of the American Electro-platers' Society held its annual banquet and open meeting on Saturday, February 21st, at the Aldine Club, 200 Fifth Avenue, New York. The educational session began at 3:30 P.M., being opened by **Joseph Musante, Jr.,** who turned the meeting over to the president of the New York Branch, **Fred Haushalter.** Mr. Haushalter made a short speech of welcome to the members and guests and in turn turned over the meeting to **Charles H. Proctor,** who acted as chairman.

The first paper was read by **Dr. R. W. Mitchell,** Technical Director of the Magnus Chemical Company, Garwood, N. J., on the subject of Industrial Metal Cleaners. Dr. Mitchell described the mechanics of cleaning, the formation of emulsions with oils and gave a number of the basic principles of correct cleaning of metals before plating. He showed samples of the raw materials which go into cleaning compounds. One exhibit of special interest was some pieces of zinc base and aluminum base alloys which had been ball burnished to a bright finish by the aid of a special cleaning compound.

**R. J. Liguori,** Plating Foreman of the Bommer Spring Hinge Company, read a paper on Practical Chromium Plating, in which he described the operations in his plant in plating and finishing small hardware parts made of cast and sheet brass, bronze and iron. Mr. Liguori stressed the fact that the undercoat of nickel is of prime importance in chromium plating.

**Dr. L. C. Pan,** Instructor in Electroplating at the College of the City of New York, read a paper on Throwing Power of Sulphate Zinc Solutions. Dr. Pan discussed the advantages and disadvantages of sulphate and cyanide solutions for zinc. He described his research into the sulphate solution and his efforts to improve the throwing power of those solutions by the aid of addition agents like pyridine. He was able to obtain good throwing power and at the same time retain most of the other valuable properties of the zinc sulphate solution. The paper was followed by an animated discussion on the comparative advantages of sulphate and cyanide solutions for zinc.

**John Rolff,** read a paper on Mechanical Plating, in which he explained the operation of plating barrels, their care and upkeep, their parts and construction. He described the best methods of handling materials in barrels and gave a number of detailed pointers about the operation of a barrel plating plant.

**Oliver J. Sizelove,** Plating Supervisor, Goertz and Company of Newark, N. J., and Associate Editor of THE METAL INDUSTRY, read a paper on Gilding Solutions. Mr. Sizelove described the methods and equipment required for gold plating by the three known methods, namely cyanide solution, salt water and immersion. He also detailed methods of obtaining various colored golds.

After the educational session, the members adjourned to the banquet hall.

The educational session was the best that has been held by the New York Branch in many years. The papers were high grade and thoroughly practical in character. The discussion was warm and the meeting undoubtedly one of the most interesting ever held.

The banquet was the usual happy affair staged by the New York Branch.

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## Tests of Zinc-Alloy Die-Cast Gears

The use of zinc base die-cast gears in the automotive industry is discussed in a paper by Robert M. Curts of the New Jersey Zinc Company, New York, which was read before the annual meeting of the Society of Automotive Engineers, at Detroit, Mich., in January. Mr. Curts makes a comparison of the use of die-cast and cut brass gears under various conditions, and finds that despite the obvious limitations on the use of the die-cast gears, they have some very good qualities and that in proper applications may be found superior to the brass gears. He says that several years ago a thorough investigation was undertaken in a technical-school laboratory in cooperation with engineers of a company that specialized in manufacturing gears. The principal object was to study the wear resistance of zinc-base die-cast gears in comparison with standard cut brass gears. The results were so decidedly in favor of the die-cast gears that further tests were made in comparison with cut gears of cast iron and of steel. The results of these investigations are briefly summarized as follows:

1. Die-cast zinc-alloy gears deteriorate more rapidly than cut brass gears when lubricants containing acid animal-fat are used.
2. When no lubricant was used and when lubricants showing no acid reaction were employed, the die-cast zinc-alloy gears showed a marked superiority over brass gears with regard to wear.
3. Cut brass gears have better wearing qualities than die-cast zinc gears when kept thoroughly lubricated with light mineral oil.
4. Cast-iron gears were better than die-cast zinc gears under the same conditions as those mentioned in paragraph 3.
5. When the gears are run dry, the die-cast zinc-alloy gears are superior to steel gears.
6. The die-cast zinc-alloy gears broke under a load of 3461 pounds per inch of face, as compared with 1996 pounds per inch of face for cast iron.

The tests, while not complete in every respect, indicate that, when the proper alloy is used, a die-cast zinc-alloy gear has relatively good wearing properties, especially when a lubricant cannot be constantly applied; and that, in comparison with cast iron, the impact strength of the zinc alloy is much greater than that of cast iron. This is further substantiated by the Charpy impact test. At present, die-cast zinc-alloy gears are used successfully in assemblies for regulating seats, windows and windshields. They are also used in connection with the roadside gasoline pump. No doubt they would serve equally well in other places.

# All-Metal Sectional Houses in Use in Germany

A FURTHER advance in the already familiar use of sectional houses is the adaptation of all-metal construction to this type of dwelling. This has been done in Germany, where such houses have been placed on the market at about $1,000 each, without plumbing or furnishings. Exteriors of the houses are completely of copper, with finished sheet steel for the interiors, except floors, which are wood. Patents on such houses have been granted in this country to Frigyes Forster of Budapest, Hungary, according to the "Copper and Brass Bulletin."

Wooden or steel skeleton frames and suitable insulation are placed between the outer and inner metal surfaces. The advantages are said to be high resistance to corrosion of exterior, due to the copper; economy of fabrication; and ease of erection, which is accomplished solely by the use of tie bolts. Mass production methods are to be applied to manufacture of the sections.

Considerable attention has been given abroad to the use of metals instead of masonry in general construction. The use of steel framework, it is stated, makes it possible to eliminate brick and stone to a large extent, since the walls are then merely enclosing surfaces rather than load-bearing masses. Glass and metal walls, with practically no masonry, have been found very successful even for church buildings, which have for centuries been most extensive users of brick and stone.

Interior View in the House Shown Below

An interesting American house built largely of metal was recently demolished in Brooklyn, N. Y. This was a large residence built about 40 years ago by Niels Poulson, a pioneer in the use of metals in construction. His house was steel framed and completely copper sheathed, with floors of steel and concrete. When it was taken down the construction was examined and found to be practically as well designed as the very latest construction practice would have made it. Its state of preservation was nearly perfect.

**Exterior of German Dwelling Built Largely of Metal. The Walls and Roof Are Covered with Copper**

# THE METAL INDUSTRY

With Which Are Incorporated
**The Aluminum World, Copper and Brass, The Brass Founder and Finisher, The Electro-Platers' Review**

**Member of Audit Bureau of Circulations and The Associated Business Papers**

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ADOLPH BREGMAN.................Managing Editor
THOMAS A. TRUMBOUR..........Business Manager
EVAN J. ROBINSON.............Advertising Manager

**Address all correspondence to The Metal Industry, 99 John St., New York. Telephone, BEekman 3—0404. Cable Address Metalustry.**

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# Editorial

## A Great Metallurgical Gathering

THE Institute of Metals Division which recently held its winter meeting in New York (see page 103 of this issue for a report) made a deep impression upon its own members and upon the many guests who took advantage of the general invitation to attend. There, in one room, meeting several times during the week, was a gathering of the foremost metallurgists of the United States. In all directions and close at hand could be seen men whose names were nationally known for the important work they had done in their specialties, deeply intent on the reports of other men who were specialists in different fields. There were experts on aluminum, experts on brass and copper, experts on lead and tin, experts on zinc and experts on nickel. To be sure, each expert knew something about the other man's specialty, but no one ventured opinions outside of his own domain. There were also experts on metallography, spectroscopy and X-ray work, and it must be admitted that at least in the last named category there were few who could rise to the heights of such lecturers as Dr. Westgren although the audience was large and hungry for information.

The sessions of the Division included work on rolling, forming and stamping metals as well as microscopic investigation, and thus the man in the plant was taken care of as well as the man in the laboratory, even though the laboratory men were in the majority. Perhaps this is natural and best under the circumstances.

In working with non-ferrous alloys in the past it has been our experience that the man in the plant knows what happens, but it takes the laboratory man to tell him why. It is a long time since the theoretical metallurgist was held in contempt because he could only tell why things happened after they had happened. Now we know that this is the first step in the march of progress. Once we know why phenomena occur and we have the explanations of reactions which we have known for a long time, we can use these explanations to explore new fields. The laboratory has become increasingly active in discovering new alloys and improvements, and fewer advances are coming from hit-and-miss or accidental discoveries. Shining examples of this fact are the development of the strong aluminum alloys with their properties of age hardening, the greatly expanded and still rapidly growing use of silicon in aluminum and copper alloys, the development of zinc die casting alloys containing fractional percentages of magnesium, and the growing use of lead-calcium alloys.

There will never be a time when the man in the shop and on the foundry floor will not be responsible for what goes on. He must always know what is happening and how things are being done. But more and more his methods will be aided and guided by the answer to the question "Why?" which the laboratory supplies him. Working alone, each one is handicapped, but working together they are more than doubly powerful.

## Improving the Non-Ferrous Foundry

THE American Foundrymen's Association is making an earnest effort to stimulate the interest of brass, bronze and aluminum foundries in technical and economic improvements which they have been lacking. For the coming meeting, to be held in Chicago, May 4-7, 1931, a substantial program is being arranged which will cover practical operating questions in the mixing, molding and casting of non-ferrous alloys, the mechanical and material handling features of foundry work, and last but certainly not least, improved cost methods. There will be formal sessions and round table discussions.

We have known for decades that there are far too many alloys on our lists, many of which are overlapping, and many almost useless. This problem has been the point of attack of important work by the American Foundrymen's Association together with the American Society for Testing Materials and the Non-Ferrous Ingot Metal Institute. It seems that order is being brought out of chaos and that in the not too distant future, standardization will be accepted. But this is only one of the many problems of the industry. How are the rest to be solved? By research, and it is research that the American Foundrymen's Association is interested in, together with education of the industry by spreading its findings.

In the long run the greatest hope for an industry is in the strength and vigor of its technical and trade organizations. The non-ferrous foundry is no exception to this rule. In the American Foundrymen's Association it has a direct representative, ready to be useful at every turn and asking only to be given work to do. The Association deserves the membership and co-operation of every brass foundryman, and every brass foundryman owes it to himself to attend its meetings, keep in touch with its transactions and alive to its literature.

There is no more important work being carried on today to the brass casting industry than that in the hands of the American Foundrymen's Association.

## Metals in Our Lives

THE metal industries have awakened to the need for informing the public about the importance of the products which they supply and the difference which their efforts make in the lives of the woman in the home and the man in the street. It is not too much to say that metals form one of the corner pillars of our industrial civilization.

Gold is romantic, valuable and of course, very much desired, but outside of financial fields, plays a small part in industry. Unquestionably, the most important metals are those which are known as "base"—iron, copper, zinc, tin, lead, aluminum and nickel. Out of a few base materials, there are as many as 5,000 combinations in the form of alloys which are serving men's needs. Civilization could not go on without even such seemingly small knick-knacks as knives, watches, building hardware, electric lights and telephones, to say nothing of the bulky uses of metals so prominently displayed before us, such as steel structures, railroads, ships and automobiles.

A radio talk recently given by Dr. Zay Jeffries on Metals and Alloys, told of the fundamental importance of metals in modern society. Besides enumerating the large uses of the common metals, he pointed out the need for the less generally known elements such as mercury, tungsten and magnesium. He explained also the improvement in these alloys which had been effected by the increased knowledge gained through investigating them under the high power microscope and with the X-ray.

We are glad that metals are getting a hearing in public through the medium of the radio. Perhaps the public will soon learn that the term "solid brass" is a commendation and not a deprecation, signifying an imitator of gold. It will be well for the public to know that without copper we could not have the widespread use of electric light, and that without strong aluminum alloys, we could not have airships of the Zeppelin type and the highly improved airplanes we have today. The public should also know that gold and platinum are fundamentally more important because they are resistant to corrosion and can therefore be better used in industry, than they are in jewelry. They should also know that zinc is one of the most important protectors against rust, and also an indispensable factor in paints and pigments. They should not be ignorant of the fact that lead is necessary in solder, bearings, paints, cable covering and much more recently, in mattresses to absorb shock in building and machinery foundations.

There are many other things of interest that the general public should know about metals to understand them better and respect them more. The advantage to metal producers and manufacturers would be not only sentimental, but very concrete from a business standpoint. These radio talks should be continued.

## New Plating Developments

THERE are indications and definite plans afoot which have the possibility of giving the electroplating industry renewed impetus.

In the first place there is a real rise of interest in bimetal deposits. Not that the deposition of two metals together is new in principle. Brass has been electroplated for many years. But we seem to have renewed interest in others which may develop into sturdy soldiers in the ranks of plated metals, such as iron-nickel, nickel-cobalt, lead-thallium. Nickel-cobalt gives a silver white deposit, much harder than nickel and in many cases much more resistant to corrosion. The lead-thallium combination is highly insoluble when it contains thallium from 20 to 65 per cent, and should find a ready market in the chemical industry.

The latest to join the electroplated metals are tantalum and rhodium which are of special interest to the jewelry and flatware trades. Rhodium gives a finish which is said to resemble platinum. It is hard and highly resistant to tarnish. It seems to be finding a real welcome among manufacturers of jewelry, to replace platinum which is still very expensive, and to eliminate platinum plating which is, at best, difficult and in many ways unsatisfactory under our present methods. In some cases it has been reported that the silverware is first covered with a coating of palladium which protects it against the attack of the solution into which it is subsequently placed for the final plate of rhodium. Articles treated in this fashion have already appeared on the market.

It is impossible to predict at this time the extent to which these novel finishes and protective coatings will grow in favor. In industry we know that if a product is suitable it will find its place. In materials which go to the consuming public there are many other factors impossible to determine accurately. It may be that the public will take up palladium and rhodium plating as it took up chromium plate. It may also be, however, that the beautiful appearance of Sterling silver, still unsurpassed in many ways, will hold first place in the affections of its users.

In any case, the development of new plated finishes must react to the advantage, not only of electroplating as an industry, but also the basic metal producers. If rhodium plating on Sterling silver takes the public fancy, Sterling silver will be sold in larger quantities. If rhodium plating on jewelry catches hold, more jewelry will be sold.

All of which proves, regardless of conjectures, prophecies and other types of guesses, that the electroplating industry is awake in every sense of the word—technically and commercially.

## Rays of Sunlight

THERE are very definite indications that the dawn of better times is here. One of these, and perhaps the most reliable is a report issued on March 1st by the President's National Business Survey Conference, which is more encouraging than any given out by that Conference in the past nine months. Guarded as that group is, it has never in the past offered a general interpretation of the facts which it has gathered until now, when it says specifically that it sees an improving trend from the low point in December, and new confidence and energy which are apparently themselves the proofs of improved conditions. Julius H. Barnes, chairman, also finds the world's business conditions beginning to turn upward.

There are in addition, many straws which show which way the wind is beginning to blow. The Tariff Commission, reorganized only about six months ago, recently submitted its first report to President Hoover. In this report, seven items were considered, one rate was advanced and six were reduced. This is extremely encouraging, not because of the preponderance of reductions but because it is evidence that the Commission is active, that it is not (as has been charged) wedded to the policy of higher and higher tariffs regardless of changing conditions, and because of the speed and unanimity of its decisions. It presages the removal of the tariff from politics, which is something that even the most hopeful had felt almost impossible. Knowing so little about the actual effect of the tariff on American business, because of the short time which has elapsed since its enactment and its complication with the general, world-wide depression, we are unable as yet to form any trustworthy conclusions. But it is most encouraging that the Commission is acting in a non-political manner and acting quickly.

The winter is rapidly drawing to a close and with it will pass a large part of the troubles to which winters often subject us. Spring is clearly bringing at least a seasonal revival in business with corresponding increases in employment, amelioration of suffering and improved purchasing power. Steps which have been taken by industry to tide over this hard time are well summarized by the answers to a recent referendum conducted among New England manufacturers in which the preponderance of opinion recommended the promotion of employment maintenance by the reduction of weekly hours rather than lay-offs; aggressive merchandising by developing new products; the improvement of quality in merchandise, methods of packing and general appearance; the maintenance of employee morale by providing wages and working conditions on levels which will enable employees to prosper. Such measures have undoubtedly been responsible, to the extent to which they could be applied, together with emergency relief measures, for tiding over as well as we have this winter of our discontent. We see directly before us unmistakable evidence that a seasonal rise at least is in progress. That it is not a false rise like that of 1930 is proved by its steadiness and comparative slowness.

We can only hope that the stock market will be persuaded to restrain itself and if it must act in advance of business, at least, not to get out of hand, inviting subsequent reactions, thus starting another of the vicious circles to which we have been subjected for the past eighteen months. The watchword now should be "Steady and not too fast."

# Correspondence and Discussion

## Who Invented the Crimped Wire Brush?

To the Editor of THE METAL INDUSTRY:

I have noted with interest your inquiry, "Who Invented the Crimped Wire Brush?" in the January issue of THE METAL INDUSTRY.

This inquiry is not so simple as it may seem. The official class in the Patent Office for brushes has 269 sub-classes containing distinct types of brushing and scrubbing implements. Each of these sub-classes may contain from 25 to 100 patents. Brushes are also found in class 300 containing 21 sub-classes for brush making devices. Brushes can be found scattered in many other official classes, such as coating devices, pasting devices and wire working.

I wouldn't be surprised that at least 10,000 patents would have to be read in order to find the first crimped wire brush.

By a simple process of elimination (and this is a very dark secret obtainable only by many years of experience) I did not have to read 10,000 patents in order to answer your inquiry. The earliest patent which I located in a hurried search is No. 611,114 to Dryden B. Forward, dated September 20, 1898, shows a crimped wire brush. A copy of the patent is enclosed.

J. ROSSMAN, Chemical Engineer.

Washington, D. C., February, 1931.

## Good-bye, Old Timer, Happy Days!

To the Editor of THE METAL INDUSTRY:

I am in receipt of your subscription invoice for the year beginning January, 1931, and beg to advise you that it is my desire to discontinue my subscription to THE METAL INDUSTRY.

I have been a constant subscriber for about twenty-three years, and take great pleasure in assuring that the knowledge which I have gained through your publication has been invaluable to me. Therefore I desire to extend to you my very hearty appreciation of the service which you have rendered.

My only reason for discontinuing my subscription is due to my retirement from the business.

With my best wishes for your continued success in the services which you are rendering to the trade,

ALFRED BURTON.
Subscriber since January 1908.

Winnipeg, Manitoba,
December, 1930.

## "All Platers Should Have It"

To the Editor of THE METAL INDUSTRY:

I enclose money order for my subscription for the coming year.

I think your book is one of the best, and all platers should have it.

C. WILLIAMS.

Birmingham, England, January, 1931.

## Lacquer Prices and Quality

The February issue contained a letter with the above title. The fourth paragraph contained an error and should have read as follows:

"As far as we know, a fair grade of lacquer cannot be sold under three dollars ($3.00) per gallon (in drums)" etc., instead of "in barrels" as printed.—Ed.

# New Books

**Can Business Prevent Unemployment?** By S. A. Lewisohn, E. G. Draper, J. R. Commons, D. D. Lescohier. Published by Alfred A. Knopf, New York. Size 5 x 7½, 226 pages. Price $2.00. The answer to this question is, "Yes—to a great degree" as given by two eminent industrialists and two economists who co-operated in writing this book. It is the thesis of the authors that business can increase its profits by preventing unemployment. They believe that the employers' intelligent self-interest and not the workers' fear should turn the wheels of industry.

**Sheet Steel and Tin Plate.** By R. W. Shannon. Published by the Chemical Catalog Company, Inc., New York. Size 6 x 9, 285 pages. Price $5.00.

Sheet Steel and Tin Plate is a book on production from the standpoint of its utilization as well as manufacture. It describes its products from the raw material to the finished product, giving full technical details of methods of operation and commercial information.

Readers of THE METAL INDUSTRY will be particularly interested in the sections on galvanizing and tinning and the chapter on protective coatings.

**Soviet Union Year-Book, 1930.** George Allen and Unwin, Ltd., London, England. Obtainable in America from Amtorg Trading Corporation, 261 Fifth Avenue, New York City. 600 pages, 4½ x 7; price, $2.50.

This is the official annual review of Soviet Russian activities, edited by Drs. Santalov and Segal. It is a veritable mine of information on Russian affairs, covering economic, sociological and political matters. Complete statistics of Russian trade with all other countries; manufactures; plans for development, etc.; and maps of the Union of Soviet Socialist Republics are included. It is undoubtedly the foundation of any set of data on Russian business and cannot be overlooked by anyone desiring to trade with that country, or even to discuss such business. Absence of opinion and definite statement of factual material only makes it an excellent handbook. It is indexed and information is easily extracted. Its explanations of the Russian industrial trusts and concessions are particularly valuable to anyone seeking to understand how business is conducted in the Soviet Union.

## Government Publications

**Government publications are available from the Superintendent of Documents, Government Printing Office, Washington, D. C., to whom proper remittance should be made to cover price where a charge is mentioned. In some cases, as indicated application should be made to the governmental body responsible for the publication.**

**Annual Report of the Public Printer—1930.** United States Government Printing Office, Washington, D. C. Contains full report of government printing activities, including research on various phases of the work, including electrotyping, type metal, etc. Free.

**Hospital Plumbing Fixtures.** Bureau of Standards. Simplified Practice Recommendation R106-30. Pamphlet on elimination of waste through simplification. 10 cents.

**Use of Bismuth in Fusible Alloys.** Bureau of Standards Circular 388. 5 cents.

**American Standard Specifications for Dry Cells and Batteries.** Bureau of Standards Circular 390. 5 cents.

# Shop Problems

## This Department Will Answer Questions Relating to Shop Practice.



**Solutions sent for analysis must be PROPERLY PACKED, to prevent leakage and breakage. Chromium solutions should be sealed with glass stoppers. Label with name and address of sender.**

### Casting Lead

Q.—I am again taking the liberty of writing you regarding some trouble I am having in casting metal name plates in plaster molds. I have been using a small percentage of lime in my plaster and pouring a lead-base metal, approximately 84 lead, 4 tin, 12 antimony.

My first difficulty was the casting would blister. I thought the mold was not thoroughly dry, so tried baking it about a half-hour in a gas oven and think it possible I might have baked it too long as two of them cracked after pouring the metal. I have tried pouring with the mold face down flat, and also with the mold standing upright.

Will you kindly advise what you think is the most satisfactory position to place mold for pouring, and also the length of time or heat required to dry out molds for pouring this alloy?

A.—We see no reason why you should use plaster molds for casting a lead-base alloy for name plates. Why not a permanent mold made of bronze? This would cast such alloy much better and cheaper than plaster molds. However, if you want to use plaster molds you will have to arrange to expel all the moisture in your mold.

Your idea of using lime with the plaster is the general practice in plaster molding. However, after the molds are poured in plaster they are put in an oven and held twelve hours at about 650 degrees Fahrenheit, then taken from the oven and poured as soon as possible, and very good castings should be the result.

As we have stated above, such work can be made very satisfactorily in permanent molds made of bronze, and we suggest that you look into this matter.

W. J. R., Problem 4,065.

### Color on Etched Metal

Q.—I am interested in the manufacture of etched name plates of brass, bronze, aluminum, etc., and would like to know how backgrounds of two or more colors are cheaply applied. I understand that a black background is produced by plating, but am not certain how red or green are applied in combination with this.

As these plates are produced in groups, what is the common way of cutting them accurately apart and producing smooth, clean edges?

If you have any books, pamphlets or reprints you could recommend I would be very glad to know of them.

A.—To fill in backgrounds with colors where a plating or oxidizing solution cannot be used, the easiest and most economical method is to use oil enamel paint of the color desired. Surplus paint on the high lights can be readily removed, either with the hand or a piece of flat felt, before the paint sets, which takes place quickly. Suitable enamel paints for this purpose may be purchased from manufacturers advertising in THE METAL INDUSTRY (see "Buyers' Guide").

After etching, the sheets may be cut either by blanking dies in a power press or with a tinner's slitting shears. Either method will leave good, clean edges.

General information on etching processes may be found in "Metal Workers' Handy Book of Receipts and Processes" by Brannt, and "Henleys XX Century Book of Recipes, Formulas and Processes," either of which can be purchased through this journal. Also, refer to THE METAL INDUSTRY, March, 1930, pages 115 and 125, and August, 1930, page 386.

W. F., Problem 4,066.

### Color of Valve Bodies

Q.—We are sending you two samples of valve bodies. Please examine these. You will note that the smaller one is unsatisfactory in appearance. How can we get a correct finish on the small one? The metal is the same in both valve bodies.

A.—We note the small T-body has been rumbled, whereas the large one was not so treated.

We would suggest that for this size casting (the small one), you dip it in a tank of water and blow out the core four minutes after pouring. This will color the casting if the metal is of good grade.

One of the methods used by large manufacturers of such work is to tumble in water with a lot of slag, then dip in acid for color, then in hot water so that they will dry without tarnishing. Your plating department should know how to bring out the color.

W. J. R., Problem 4,067.

### Data on Hot Rolling Copper

Q.—We are interested in books on hot rolling copper in rod or sheet form. If you have published anything on the subject or know of anything published by other companies, won't you please give us a list of them?

A.—There are no publications covering this subject that would be of value from an operating standpoint.

The practice on the breaking-down mill that reduces the copper cake to a "slab," and on the finishing hot mill that "pack-rolls" the cut slabs into sheet form, is controlled largely by the different widths of metal to be rolled, and these in turn create changes in the roll shape by differences in heat distribution.

These conditions are met by the experience and skill of the roller, and no writer has attempted a practical standardization of this practice for publication as far as we know.

In hot rolling copper rods, where a fixed condition prevails, i.e., the grooved roll, the manufacturers of the equipment used are in a position to furnish complete instructions and much valuable advice on the handling of this material.

W. J. P., Problem 4,068.

## Discoloration of Copper by Rubber

Q.—We are having some difficulty in obtaining information as to the corrosive effect soft vulcanized rubber would have when brought in contact with telephone parts made of brass or copper which is oxidized and then finished with a coat of lacquer.

If you are able to give us some information regarding the above question, it will be greatly appreciated.

A.—Sulphur is one of the substances used in vulcanizing rubber. It is difficult to use just the exact amount of sulphur and not leave some free sulphur in the finished vulcanized rubber.

Sulphur attacks copper and copper alloys very readily, forming sulphide of copper. Copper sulphide is black; therefore, when brass comes in contact with vulcanized rubber which contains free sulphur, the surface of the brass becomes discolored, due to the formation of copper sulphide.

Lacquer coatings are readily broken down by sulphur in the presence of the moisture in the atmosphere, and consequently do not afford any protection to the brass.

The action of the sulphur on brass continues until all the sulphur in contact with the brass is converted to copper sulphide.

A new method for vulcanizing rubber has been recently developed without the use of sulphur. Tri-nitrobenzene is used. We are not sufficiently acquainted with this process to make any statements regarding its value, and must refer you to rubber manufacturers. G. B. H., Problem 4,069.

## Four-High Brass Rolling Mills

Q.—I would like to know if you have any information as to the operation of four-high rolling mills, such as are being used by some of the brass mills in the United States, I understand.

A.—The operation of four-high mills offers the advantages of a stiffer roll, and, in some classes of work, obviates the necessity of shaping the roll, grinding for centers, as the re-inforcing rolls prevent any spring in the working roll, and admits of a greater reduction with a flat roll.

The four-high mills have found a definite place in the steel mills, but as yet have made little headway in the brass and copper mills.

One of the brass mills recently completed is equipped with the old form of two-high mills. W. J. P., Problem 4,070.

## "Non-Sparking" Metal

Q.—We have an inquiry for yellow brass non-sparking metal. We are unacquainted with the mixture specially adapted for this purpose. If there is such, will you kindly advise us what it is?

A.—Any of the yellow brass mixtures are non-sparking. The trouble with such mixtures is that dross gets in the metal. This will cause the spark. It is necessary to have clean metal, free from dross and dirt, and we suggest a mixture made of clean metal, that is, new copper and slab zinc, as follows: 74 per cent copper, 1 per cent tin, ¼ per cent lead, remainder zinc.

This metal should run clean and free from dross if gated properly. As stated above, see that your castings are clean and free from dirt or dross, and this mixture will be satisfactory.

W. J. R., Problem 4,071.

## Plating Die-Cast and Allegheny

Q.—We desire to nickel plate and copper plate a metal made by the National Lead Company known as 126-C. This is 94 zinc, 5 aluminum and 1 copper. Can you give us the necessary steps in plating this metal, and also in plating Allegheny metal?

A.—You should have no trouble nickel plating the 126-C metal in the following solution:

| | |
|---|---|
| Double nickel salts | 10 oz. |
| Sodium chloride | 7 oz. |
| Boric acid | 2 oz. |
| Sodium citrate | 1 oz. |
| Sodium sulphate (anhydrous) | 4 oz. |
| Water | 1 gallon |

The work should be cleaned in a mild alkaline cleaner made of trisodium phosphate 2 ounces, carbonate soda 2 ounces, water 1 gallon; or with one of the prepared commercial cleaners made especially for the cleaning of die-cast metal.

After cleaning, rinse in clean cold water, pickle in a 1 per cent solution of 48 per cent hydrofluoric acid and water until there is a slight etching of the surface, and then plate in the nickel solution.

Use the nickel solution at room temperature. When the work is placed in the nickel solution, strike at a current density of 15 to 20 amperes per square foot for a few seconds. Then reduce current density to 8 to 10 amperes per square foot, and plate for 8 to 10 minutes.

After the work has been nickel plated it can be copper plated in either the cyanide or acid copper solution.

The plating of Allegheny metal presents quite a problem, and we are unable to tell you how to plate this metal successfully with any deposit except chromium. It can be plated directly in a chromium plating solution with good results.

O. J. S., Problem 4,072.

## Plating Flat Irons

Q.—I am sending you a sample of my nickel solution, which has been giving me trouble. I have about 250 gallons of it, for still plating. Work comes out streaky, looking as though it were burnt. The solution is used for flat-iron bottoms, which are placed three on a hook. They come out black part way along the edges, about halfway down each side. They will not color up when buffed. The hooks also come out black.

A.—Analysis of nickel solution:

| | |
|---|---|
| Metallic nickel | 1.66 oz. |
| Chlorides | 0.49 oz. |
| pH | 5.6 |

Analysis shows that solution is in a poor condition for work such as you are doing. We suggest that you add to the 250 gallon solution 60 lbs. of single nickel salts, 30 lbs. of sodium chloride, and 30 lbs. of boric acid. O. J. S., Problem 4,073.

## Silver Plating

Q.—Under separate cover I am sending samples of silver and nickel solutions for analysis. The nickel plates a little dark; it is an old solution.

In regard to the silver plating, I have a 300 ampere motor-generator set which has been giving good service for several years. A few weeks ago I noticed that the voltage on my silver tank had begun to creep up about an hour after beginning to plate. At the start I would have 10 amperes at ¾ volt, then, without touching it, the voltmeter would show 2 volts or more, and the amperage would be down to practically nothing. The hooks on which the anodes are hung gave off dark streaks and gas bubbles, and the anodes became dark. The work ceased to get a deposit. On shutting off the current from the tank, one volt would be registered on the voltmeter for that tank, for about one minute, when it would gradually drop to zero. In order to plate I have to use about 2½ volts in the silver tank in order to get amperage. I never get more than 1 ampere per square foot. I have a circular, six-segment rheostat. Since the trouble began, the generator has been gone over thoroughly, but the trouble remains. The voltage on the nickel tank remains even, but of course I use from 1½ to 2 volts for nickel plating.

Can you suggest any reason why the voltage rises and the amperage drops? And why it takes an hour for this to happen? Is it normal for the solution to become charged and show a volt after the tank rheostat is closed?

A.—Analysis of nickel solution:

| | |
|---|---|
| Metallic nickel | 1.91 oz. |
| Chlorides | 7.17 oz. |
| pH | 6.8 |

Analysis of silver solution:

| | |
|---|---|
| Metallic silver | 3.45 oz. |
| Free cyanide | 13.85 oz. |

The chloride content and the pH are both too high. Add 20 fluid ounces of c.p. sulfuric acid to each 100 gallons of the nickel solution to correct the pH.

The free cyanide of the silver solution is entirely too high. Do not add any more cyanide for some time to come.

The trouble you are having with an uneven flow of current is undoubtedly due to the type of rheostat you are using. Procure a proper rheostat for a silver solution, and you will not have this trouble. O. J. S., Problem 4,074.

# Patents

## A Review of Current Patents of Interest

**Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.**

1,788,616. January 13, 1931. **Light-Metal Alloy and Method of Making Same.** Edward C. Burdick, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich., a Corporation of Michigan.

As a new product, a magnesium-aluminum-copper-manganese alloy consisting of approximately ninety-three per cent magnesium, six per cent aluminum, seven-tenths of one per cent of copper, and one-quarter of one per cent of manganese.

1,788,751. January 13, 1931. **Aluminum Alloy.** Eugen Strasser, Rorschach, Switzerland, assignor to Max Dietiker, Zurich, Switzerland.

A method of manufacturing an aluminum alloy casting consisting in making a preliminary alloy of approximately 90% copper and 5% nickel, covering the same with a fused layer of potassium-fluoride adapted to scorify the metal oxides present, adding approximately 5% of magnesium while stirring and then casting the preliminary alloy.

1,788,755. January 13, 1931. **Coated Metal Body.** Earl R. Wehr and Carl C. Mahlie, Middletown, Ohio, assignors to The American Rolling Mill Company, Middletown, Ohio.

A process for preparing ferrous metal bodies so that they will have a permanent rough textured surface, which consists in applying thereto an alloy of zinc and aluminum in a molten condition, and thereafter heating the body and coating to a temperature approximately the melting point of the coating or above, so as to bring about a crystalline rearrangement.

1,789,054. January 13, 1931. **Cold Brass Rolling.** John C. Sharp, Oak Park, Ill., assignor to Standard Oil Company, Whiting, Ind.

In the method of rolling soft metals such as brass by means of cold rolls to which the metal is delivered with a wetted surface, applying to the metal before entering the cold rolls a lubricant oil containing an alkali metal compound of petroleum sulfonic acids and passing the metal through the rolls, thereby lubricating the surfaces of the latter and evenly distributing the lubricating oil over the surface of the metal.

1,789,149. January 13, 1931. **Brass-Melting Furnace.** Adolph W. Machlet, Elizabeth, N. J.

A brass-melter including a metal bottle including a barrel-portion at one end, a furnace including end walls through which the ends of the bottle project, heating means within the furnace, means for partitioning off the bottle from the projecting barrel-portion, said bottle having a shoulder at its other end, said shoulder having a neck terminating in a mouth and forming one of the projecting ends, means supporting said projecting ends for rotation, and rotating means connected to said bottle, said bottle being made of metal having substantially higher melting point than brass and not amalgamating with melted brass nor subject to scaling off where it is exposed to heat sufficient to melt brass.

1,789,523. January 20, 1931. **Method of Electrolytically Depositing Chromium.** Oskar Hahn, Markranstadt, near Leipzig, Germany, assignor to Chrome-Plate, Inc., Union City, N. J.

A method of electrolytically depositing metallic chromium, which consists in treating a solution containing a chromic acid radical with peroxide of hydrogen, and electrolyzing the solution.

1,789,854. January 20, 1931. **Zinc Alloy.** Leland E. Wemple, Chicago, and Floyd A. Warren, Peru, Ill., assignors to Illinois Zinc Company, Chicago, Ill.

As a composition of matter an alloy characterized by the fact that it is of substantially greater hardness than zinc composed of zinc 100 parts, copper ¼ to 2 parts and an appreciable quantity of silver, such quantity being less than the amount of copper used.

1,790,155. January 27, 1931. **Process for the Production of Beryllium Alloys.** Lewis James Keeler, Cleveland, Ohio, assignor to Berryllium Corporation of America, New York, N. Y.

The method of producing alloys of beryllium which comprises subjecting a fused bath containing beryllium compound to electrolysis under conditions capable of precipitating metallic beryllium and alternately supplying to the bath a beryllium compound and a compound of an alloying metal, capable of liberating metallic beryllium and said alloying metal, respectively, under the condition of the bath.

1,790,164. January 27, 1931. **Process for Purifying Metals and the Product Produced Thereby.** William J. Merten, Pittsburgh, Pa., assignor to Westinghouse Electric & Manufacturing Company, a Corporation of Pennsylvania.

In the process of preparing alloys comprising 10% to 28% lead, 2% to 10% tin and 62% to 88% copper and minor impurities, the steps which comprise melting the ingredients together, adding calcium carbide to the molten alloy and then permitting the alloy to cool.

1,790,213. January 27, 1931. **Coating Process.** William E. Gwaltney, Turtle Creek, Pa., assignor to Westinghouse Electric & Manufacturing Company, a Corporation of Pennsylvania.

The method of coating a fibrous non-metallic article having a plurality of constituents and having a normally smooth and non-porous surface which comprises grinding the surface to pull out one of the constituents to form counter-sunk recesses and mechanically depositing metal on the prepared surface.

1,790,289. January 27, 1931. **Electroplating Machine.** Edgar S. Thompson, Springfield, Ohio.

In a plating machine, a unitary structure adapted for suspension in a tank having parallel spaced-apart anode and cathode rods arranged along the top thereof consisting of parallel spaced-apart connected side frame members, hand holds integrally formed with the upper portion of said frame members and a barrel revolubly mounted at the lower end of said frame members.

1,790,615. January 27, 1931. **Process for the Manufacture of Metallized Fibrous Materials Metallized With A Noble Metal.** Fritz Neuber and Rudolf Nowak, Vienna, Austria, assignors to Oskar Trebitsch, Vienna, Austria.

A process for the manufacture of metallized fibrous material which comprises precipitating a noble metal in powder form in and upon said fibrous material in known manner by the reduction of a noble metal salt solution and treating said fibrous material thus coated with noble metal in powdery form with solvents which will dissolve out matter which has not been completely reduced to metallic form.

1,790,960. February 3, 1931. **Composition for Treating Metals.** Earl K. Wallace, Pittsburgh, Pa., assignor to Rust Prevention Chemical Company, Pittsburgh, Pa., a Corporation of Pennsylvania.

A compound for treating metal surfaces comprising 42½% by weight of pure phosphoric acid, 56% by weight of water, and 1½% by weight of casein.

1,791,082. February 3, 1931. **Electrolytic Zinc Bath.** Giuseppe Bianco, Turin, Italy.

An electrolytic zinc bath comprising a zinc amalgam, phosphoric acid combined with an alkali metal, sulphuric acid, aluminum hydroxide, and water.

1,791,148. February 3, 1931. **Lead Alloy.** Robert Jay Shoemaker, Chicago, Ill., assignor to S. & T. Metal Company, Chicago, Ill.

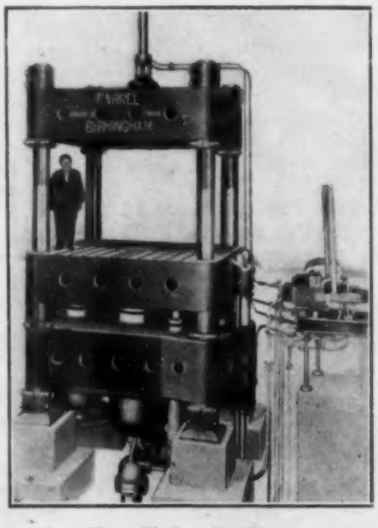
A tough, slightly hardened, non-corrosible lead alloy consisting of lead and, by weight of the alloy, from 0.01% to 0.03% lithium; from 0.1% to 0.3% calcium; from 0.25% to 0.5% tin; and from 0.02% to 0.1% aluminum.

# Equipment

## New and Useful Devices, Metals, Machinery and Supplies

### Press for Hot Forming of Tank Ends

In the new tank department of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., the ends of circuit breakers, oil switches, etc., will be hot formed on a 1500-ton hydraulic press built by the Farrel-Birmingham Company, Inc., Ansonia, Conn. This press is especially designed for flanging and forming heavy metal parts. Besides the main 34" diameter ram, which provides a pressure of 1,000 tons, the press is also equipped with two 18" diameter auxiliary rams, which provide an additional 250 tons pressure each. The press, therefore, can be used as a triple capacity machine, that is, for 500, 1,000, or 1,500 tons pressure; or the 500 ton capacity can be used for clamping operations and the 1000 ton for drawing operations.



New Hydraulic Press

The press is 97" x 85" clear between the tie rods and has a maximum opening of 72" and a stroke of 48". The overall height from the floor to the top is 13' 8½" and the distance below the floor is 20' 11½", making a total overall height of 34' 8". The floor space is 13' 3" x 9' 6".

Control and operating valves are of standard construction; spindles and seats are of alloy steel to insure long life; safety devices are provided to prevent damage to the press by incorrect operation.

### Plating Solution Brighteners

Brightening agents for nickel and cadmium electroplating solutions are offered by the E. Wambaugh Company, Goshen, Ind., manufacturers of various electroplaters' supplies. The brighteners are marketed under the names "Nickel-Brite" and "Cadmium-Brite," and can be added to any cold nickel or cadmium solutions to produce bright, lustrous deposits, according to the manufacturer. Color buffing and burnishing are eliminated on certain types of work by the use of the brighteners, it is stated, and costs are said to be materially reduced.

The company's other products include salves for platers' ailments, such as nickel itch, chromium burns, cyanide sores, etc., which the makers claim to be highly efficacious in relieving the plater from the illness or annoyance of these skin troubles.

### New Gear Lubricants

A new series of gear lubricants for all types of heavy, slow-moving, open gears has been placed on the market by E. F. Houghton and Company, Philadelphia, Pa. These are known as "Tenac," and there are four grades. The company states that ordinary greases or gear oils are not altogether satisfactory for gear lubrication because they do not entirely overcome metal-to-metal contact, and are readily thrown off when gears are in motion, causing power losses and premature wear of gears. The new Houghton lubricant, it is stated will not be thrown off the gears while they are in motion, exhaustive tests having been made with practically every type of gear installation.

The different grades of "Tenac" are designated by numbers, from No. 1 to No. 4, ranging from the heaviest to the lightest grade. No special device or method of application is required. "Tenac" gear lubricants are applied in the ordinary manner. Another point stressed is satisfactory service at very low temperatures.

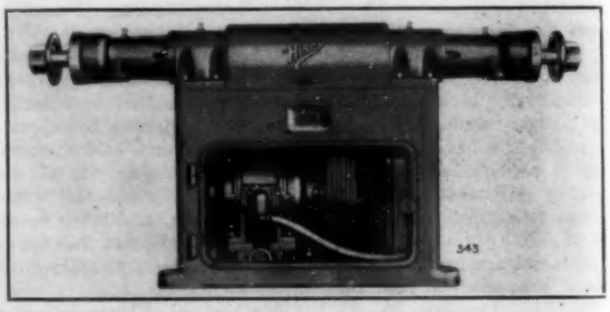
### Plating Solution Analyzing Apparatus

A new type of apparatus for analyzing all types of electroplating solutions in a rapid and practical manner is offered by E. G. Lovering, 5721 Lincoln Avenue, Detroit, Mich., and T. C. Eichstaedt, 59 Seward Avenue, Detroit, Mich., both of whom can provide full information on all phases of this equipment. In describing it, they state that the new apparatus has been found highly efficient for use by the plater who has no laboratory or who is not a chemist, having been developed by a practical plater who studied electrochemistry and saw the need of such apparatus for the practical man.

The apparatus consists of a complete outfit in a portable case about 15 by 10 by 4 inches in size. Results are shown in ounces per gallon, without calculations of any kind as to the number of drops, etc., and it is claimed that correct results are obtainable in from 10 to 20 minutes. The outfit is sold on specification, to cover the solutions for which it is to be used, and provision may be had on order for such a variety of solutions as nickel, acid copper, cyanide copper, cadmium, chromium, tin, lead, zinc, brass and silver, as well as any other solutions which may be in use. The sellers claim that the apparatus has been adopted by some chemists, who find it preferable to the ordinary chemical analysis methods.

### New Heavy Grinder and Buffer

A new, heavy-duty buffer and grinder in 10 and 15 horsepower sizes, with "Texdrive" and a number of other features has been placed on the market by The Hisey-Wolf Machine Company, Cincinnati, Ohio. The manufacturer gives the following general specifications: overall spindle length, 82 in.; spindle projection at each end, 15 in.; net weight, 2600 lbs.; unit spindle head construction.


New Hisey-Wolf Buffer and Grinder

The machine has ball-bearing motor, horizontally mounted on dovetailed sliding base, and is adjustable by hand wheel and feed screw. Flex-steel conduit and fittings are used. Spindle head is mounted on 4 ball bearings. Timken roller bearings are optional without extra charge. Door in column gives access to motor and motor starter. Flat top threads are used on wheel arbor ends to afford security in holding wheels, and Tobin bronze safety wheel nut protects thread and operator, the makers state. Complete details are available to readers addressing the manufacturer.

# New Low-Production Hot Copper Rod Mill

United Engineering and Foundry Company, Pittsburgh, Pa., has placed on the market a new type of hot copper rod mill which embodies a number of distinctive features, chief of which is its capacity for low production at low cost. In describing the new mill the company says that the average Belgian type hot copper rod mill will produce about 25,000 to 28,000 pounds of ¼" round rods per hour. A high speed continuous mill will more than double this production. Heretofore it has been generally agreed in the copper industry that any production lower than 15,000 pounds per hour is prohibitive because the labor cost per pound exceeds the limits of profitable operation.

United Engineering and Foundry Company, in response to a demand for such equipment, recently undertook the developmet of a mill which contains all modern features of design, but remains within a reasonable investment cost and labor cost, to permit profitable operation with no more than 10,000 pounds per hour. This design has now been built.

The layout is of Belgian type, consisting, briefly, of roughing train, finishing train, reels, water bosh, and the necessary tables and auxiliary. Various automatic devices of simple nature are employed to guide a 4" x 4" billet (or wire bar, as it is termed in the non-ferrous business) almost without labor from the furnace through all rolling operations, reels and conveyors, to the point where the finished coils are wired and ready for pickling.

The mill does not entirely eliminate labor; several men are required as a precautionary measure. It is believed, however, that after some months of operation, and gradual improvement of operating conditions, even the precautionary labor will be replaced with automatic safety devices. Not counting this possible future saving, the operating cost compares favorably with that of a much more expensive equipment of large tonnage capacity, according to the United Company.

Although the mill is small, no pains have been spared to incorporate in it all conveniences and improvements of latest rolling mill practice, it is stated. Roller bearings are used on mills, pinion stands, tables, and auxiliary. Steel castings are introduced at all points of shock, or heavy, different and often larger design is carefully worked into the series of operations. Roll alignment is very accurate and rigid, the equal or superior of that in much larger mills. Universal spindles are employed in the entire finishing train. Provision is made for down-draft exhaust system to remove copper fumes. The motors have adjustable speed control. Reels are of very latest type, which prevents putting a spiral into the rod, and have electric operated strippers and automatic kick-offs.

New Copper Rod Mill

The makers of the mill, who have built a number of medium production plants and also developed about a year ago the largest copper rod mill in the world, claim that the new design fulfills a long felt need for a layout of a modest investment cost, low labor and power cost, low production, and reasonably simple construction, combined with latest features of rolling mill practice, resulting in a good quality of product at a reasonable cost per pound.

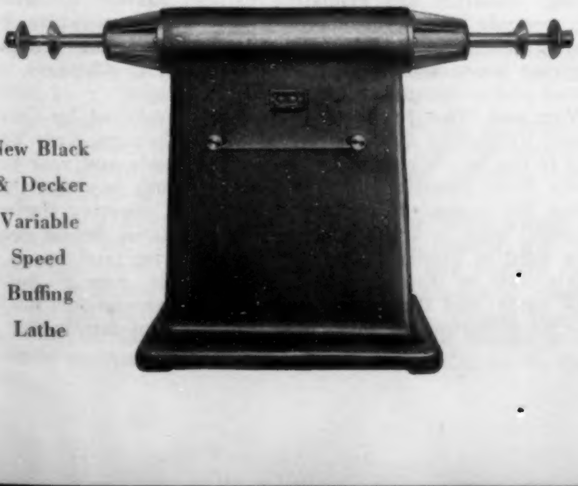
Although the mill is essentially designed for low production, it is so arranged that by means of very small changes, and with only a trifling increase in labor, it can be converted into a mill of considerably higher tonnage, and in so doing it is unnecessary to scrap any units or parts of the mill as now constructed, the maker states.

## New Selective Speed Buffers

A new type of independent spindle electric buffing machine has been placed on the market by the Black and Decker Manufacturing Company, Towson, Md. This machine provides for varying speeds and is said by the makers to be the latest development in this type of machinery, having such advantages as simplicity of design and utmost accessibility of working parts, wheel adjustment of "V"-belt tension, multiple-disc dry clutch, friction brake for stopping spindle when disengaged from motor, massive construction, and a number of other features.

Complete information is available to readers on application to the manufacturer.

New Black & Decker Variable Speed Buffing Lathe



## New Acid-Proof Iron Alloy

The Duriron Company, Dayton, Ohio, manufacturers of acid-proof metals, have their new steel foundry in full operation producing chrome-nickel and chrome-nickel-silicon alloy steels which they are adding to their line. With seventeen years' experience producing "Duriron," the well known acid-proof iron alloy, for acid service, they have produced a nickel-chrome-silicon alloy steel of their own formula for acid service where "Duriron" does not apply. It is known as "Durimet" and is available in sheets, plates, bars and castings.

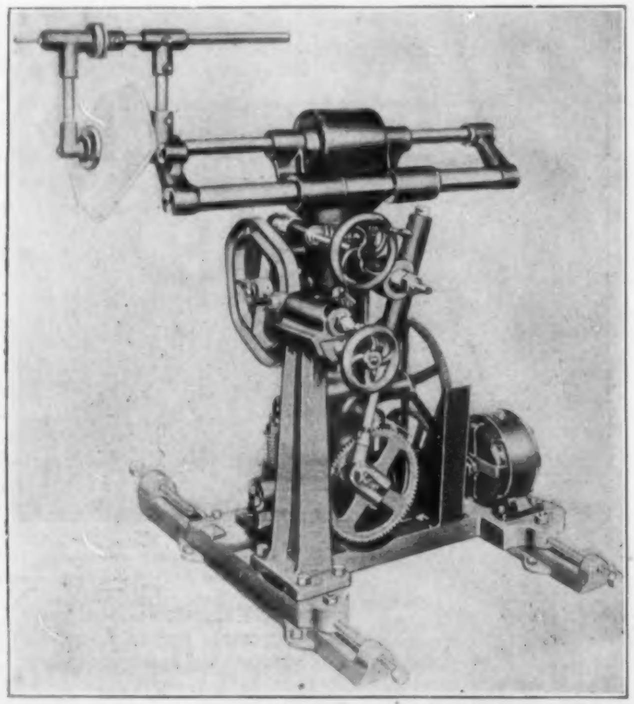
Much of the sheet stock is being used for fume ducts where corrosive conditions are present, as in telephone battery rooms and over pickling tanks. The bar stock has applications such as fabricating material, pickling tank tie rods, electrodes and so on, the makers state. Pump and fan castings, valve bodies and similar parts are being cast for acid service where high temperatures and pressures are present. A large amount of custom work has also been turned out for special applications.

A new product in "Durimet" is a "Y" valve in which the valve seat is removable and reversible; can be made into an angle valve, the valve disc is full-floating, permitting a new seating each time the valve is used.

In addition to Durimet, the Duriron Company is also casting the chrome-nickel "Nirosta" metals which are being marketed under the trade name, "Durco Nirosta." "Durimet" is recommended by the manufacturer for general use with most of the common acids, except the chlorine compounds for which they make a special analysis.

## Automatic Buffing and Polishing Machinery

Contour Buffing Machine Company, Inc., 410 Bird Avenue, Buffalo, N. Y., offer a line of automatic machinery for buffing and polishing such products as kitchen utensils, radiator shells, fire extinguishers, electrical appliances, etc. The machines are designed to feed to any standard buffing lathe automatically. They handle work having odd contours, such as rectangular, oval, triangular, etc., as well as circular or spherical shapes. The company states the machines are operated by unskilled labor, one man being able to attend to two of the machines, which are made in right-hand and left-hand types for this purpose.



**Contour Automatic Buffer and Polisher**

A variety of machines are made, one type being for odd-shaped work such as utensils and fire extinguishers; another for large work of irregular shape, such as radiator shells, washing machine covers, etc.; a four-spindle machine attachment which adapts to the machine is made around work from 5 to 12 inches in diameter, and an eight-spindle attachment for round work up to 4 inches in diameter.

The Contour company also produces an automatic wheel dresser for applying compositions to buffing or polishing wheels. Full information may be obtained by addressing the company.

## "Chromaloid" in Coils

"Chromaloid," a chromium surfaced sheet metal, is offered by its manufacturers, the American Nickeloid Company, Peru, Ill., in coils, for use in automatic fabricating machinery and for other purposes where strip and sheet metal is required in long, continuous coils. The metal is a non-tarnishing sheet, described as chrome-nickel-zinc by the makers. Its advantages include easy cleaning and ready workability, and it is stated that its use aids in eliminating plating of products, making for economy of production. The metal in coils is available in thicknesses from .006 in. to .050 in., and in widths from 1/4 in. up to 12 in.

Applications of coiled "Chromaloid" mentioned by the makers include trim for trunks, running boards and refrigerators, production of various types of buttons, frames, names plates, washers, emblems and special stampings of wide variety. Complete information will be supplied to readers addressing the manufacturer.

# Equipment and Supply Catalogs

**Canvas Cushion Truck and Caster Wheels.** Divine Brothers Company, Utica, N. Y. Leaflet.

**Duriron News.** The Duriron Company, Dayton, Ohio. Vol. VIII, No. 2, covering Chemical and Metallurgical Research; a four-page bulletin.

**Sandblast, Tumbling Mills, Dust Arresters.** The W. W. Sly Manufacturing Company, 4703 Train Avenue, Cleveland, Ohio. Circular on equipment for foundries.

**Harshaw Industrial Chemicals.** The Harshaw Chemical Company, 1945 East 97th Street, Cleveland, Ohio. Complete catalog of chemicals, in handy form, well printed.

**Recovering Smelter Dust and Oxide.** The Dust Recovering and Conveying Company, Harvard Avenue and East 116th Street, Cleveland, Ohio. Bulletin 20, very well illustrated.

**Denham Costfinder for General Managers.** The Denham Costfinding Company, 3030 Euclid Avenue, Cleveland, Ohio. No. 37 of a series of booklets relating to cost engineering.

**Thermocouples for Brass and Aluminum.** The Brown Instrument Company, Philadelphia, Pa. Broadside on two new products of importance to the metallurgical industries.

**Arc Welding Supplies.** The Lincoln Electric Company, Cleveland, Ohio. A completely illustrated catalog of supplies and equipment for all types of arc welding.

**Brown Electric $CO_2$ Meters.** The Brown Instrument Company, Philadelphia, Pa. Indicating and recording meters. Catalog 3004, 32 pages, illustrated.

**Copper Welding.** Murex Welding Processes, Ltd., Ferry Lane Works, Forest Road, London, E. 17, England. Booklet on the "Premag" process of welding.

**Nickel Steel.** International Nickel Company, Inc., 67 Wall Street, New York. Circular showing pictorial panorama of progress in use and applications of nickel steel in various industries.

**Rouge and Composition.** Zucker Sons' Company, Inc., Roselle, N. J. Leaflet describing the various brands of rouge and composition for polishing manufactured by the company under the trade mark "Pioneer".

**Copper Arts.** United States Metals Refining Company, Carteret, N. J. A handsome booklet on a new field the company is entering, showing very fine pictures of artistic bronze ware, such as bowls, ash trays, candlesticks, all finished especially to reproduce the effects of antiquity.

**Marketing Alloy Metals.** Policyholders Service Bureau, Metropolitan Life Insurance, New York. A very complete report on the marketing of alloys, covering methods of distribution, advertising and sales promotion, effective marketing radius, etc. The report is on 44 large multigraphed sheets in a binder. It should prove very interesting to anyone engaged in the metal and alloy field, and especially to those actually marketing alloy metals.

**Swartwout Industrial Ovens.** The Foundry Equipment Company, Cleveland, Ohio. Catalog 31; industrial ovens and accessory equipment for japan, enamel, paint and lacquer drying; armature and insulating varnish baking; lithographing; ceramic drying; rubber curing; low temperature heat treating; chemical drying and other manufacturing processes requiring temperatures up to 900° Fahrenheit. 48 pages, well printed and illustrated.

**Wire and Wire Products Directory.** Published by Quinn-Brown Publishing Corporation, 551 Fifth Avenue, New York. This is the fourth edition of the buyers' guide and year book of the Wire Association. The book is cloth bound, 6 by 9 inches, 195 pages. It contains information covering the wire industries both in and out of the United States, listing everything used in producing cable, wire and wire products in all metals, bare or insulated; lists of wire mills; wire machinery of all kinds; and the record of the Wire Association's history since its formation in June, 1930, and a list of members.

# Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

## American Foundrymen's Association

HEADQUARTERS, 222 WEST ADAMS STREET, CHICAGO, ILL.

### Officers Nominated

The nominating committee of the American Foundrymen's Association met at Birmingham, Ala., January 20, 1931, and named the following for officers and directors, the officers to serve one year each, the directors three years:

PRESIDENT: E. H. Ballard, general foundry and pattern shop, superintendent, General Electric Company, West Lynn, Mass., vice-president of A. F. A., 1930-1931.

VICE-PRESIDENT: T. S. Hammond, president, Whiting Corporation, Harvey, Ill., a director of the Association from 1924 to 1926.

DIRECTORS:

N. K. B. Patch, secretary, Lumen Bearing Company, Buffalo, N. Y.

Fred L. Wolf, technical superintendent, Ohio Brass Company, Mansfield, O.

Dan M. Avey, editor, "The Foundry," Cleveland.

R. J. Doty, plant manager, Reading Steel Casting Company, Reading, Pa.

W. D. Moore, president, American Cast Iron Pipe Company, Birmingham, Ala.

### Advisory Committee of Non-Ferrous Division

Organization of the non-ferrous advisory committee has just been announced, to include the members listed here. John W. Bolton, metallurgist of the Lunkenheimer Company, Cincinnati, and chairman of the non-ferrous division, also will act as chairman of the advisory group. Other members are:

William Ball, Jr., foundry superintendent, Edna Brass Manufacturing Company, Cincinnati, Ohio.

R. L. Binney, vice-president and metallurgist, Binney Castings Company, Toledo, Ohio.

G. H. Clamer, president, Ajax Metal Company, Philadelphia, Pa.

E. R. Darby, Federal Mogul Corporation, Detroit, Mich.

Dr. Paul D. Merica, International Nickel Company, New York.

N. K. B. Patch, Lumen Bearing Company, Buffalo, N. Y.

T. D. Stay, Aluminum Company of America, Cleveland, Ohio.

H. M. St. John, Detroit Lubricator Company, Detroit, Mich., and an associate editor of THE METAL INDUSTRY.

Jerome Strauss, chief research engineer, Vanadium Corporation of America, Bridgeville, Pa.

Sam Tour, vice-president, Lucius Pitkin, Inc., New York.

J. L. Wick, Jr., president and general manager, Falcon Bronze Company, Youngstown, Ohio.

H. M. Williams, Frigidaire Corporation, Dayton, Ohio.

Fred L. Wolf, technical superintendent, Ohio Brass Company, Mansfield, Ohio.

D. H. Wray, Henry Wray and Son, Inc., Rochester.

### Convention Notes

Additional exhibit space, provision for several new sessions, a broader program of papers, excellent meeting room facilities and all convention activities housed under one roof—these are the features of the 1931 convention of the American Foundrymen's Association, to be held May 4 to 7 in Chicago, which promise a highly successful Annual Foundrymen's Week. In addition, many important plants in the Chicago district will be open for inspection throughout the meeting.

Preliminary plans for the program of the convention have been well worked out by an extensive committee. Round-table luncheon meetings have been scheduled for the malleable, steel and non-ferrous groups. Chairman for the non-ferrous group will be H. F. Seifert, superintendent of brass foundry, Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. Mr. Seifert will be assisted by F. L. Wolf, technical superintendent of the Ohio Brass Company, Mansfield, Ohio.

Sessions of general interest which have been tentatively scheduled include those on foundry costs, pattern production, sand research and apprentice training. Any or all of these sessions will have much to offer in the way of value to all who attend the convention.

Two cost sessions will be held, one on general foundry costs to discuss methods of figuring molding costs and data which the purchaser should furnish when requesting bids. The second cost session will be devoted entirely to non-ferrous foundry costs.

The committees which now are organizing the sessions on metallurgical and production phases of the various branches of the foundry industry have secured a number of worth-while papers. There will be enough papers to form the basis for two sessions on non-ferrous castings.

## American Electroplaters' Society

HEADQUARTERS, CARE OF H. A. GILBERTSON, 434 SOUTH WABASH AVENUE, CHICAGO, ILLINOIS

### Annual Convention—1931

The Nineteenth Annual Convention of the American Electroplaters' Society will take place this year at the Hotel Seneca, Rochester, N. Y., from June 29 to July 2, inclusive.

The Rochester Branch is to take care of the details of preparation and it promises to be a great meeting, with platers from all parts of the United States and Canada attending, including delegations from many of the Branches.

The Rochester Branch is planning to give its fullest attention to the matter, and there is no doubt that the meeting will be completely successful. The Rochester Branch was host to the Conference on Research last year, which was attended by representatives from all the Branches in the country. Ramon Lopez, a prominent member of the Rochester Branch, is second vice-president of the American Electroplaters' Society. Charles Griffin, 24 Garson Avenue, Rochester, is secretary of the Branch, and will receive all communications regarding the convention until a committee is announced.

### Baltimore-Washington Branch

HEADQUARTERS, CARE OF I. H. HAHN, 207 SOUTH SHARP STREET, BALTIMORE, MD.

The Baltimore-Washington Branch of the American Electroplaters' Society held its annual educational session and banquet on January 31, 1931, at the Hotel Emerson, Baltimore. This was the most successful banquet and session yet held by the Branch. The program of papers was very instructive and interesting.

There were 110 people at the banquet, which was considerably enlivened by the entertainment, which was put on between courses.

IRVIN H. HAHN, Secretary.

## Boston Branch

HEADQUARTERS, CARE OF ANDREW W. GARRETT, 45 KING STREET, DORCHESTER, MASS.

The Boston Branch held a regular meeting February 5, at the American House, with fifteen members present. One application was received and was referred to the board of managers. The speaker of the evening was Mr. Casell of the Udylite Process Company, who spoke on the protection of metals from rust by cadmium plating. We also had with us Frank Clark, who will give the branch a talk at a later date.

### Chemistry Class

The chemistry class of the branch has over twenty pupils. The class meets one evening a week; one week they hear lectures and the next they have laboratory work. Each man brings his own solutions. They have been working on the nickel solution and now every man knows how to analyze this solution for metal, chloride and ammonia contents. The members find it very interesting and expect to continue this class each year. The instructor thinks the class is doing very well.

This Branch expects to hold open meetings for another membership drive, so that when the class starts again next fall for its second year, it should be much larger.

A. W. Garrett, Secretary.

## Newark Branch

HEADQUARTERS, CARE OF GEORGE REUTER, P. O. BOX 201, NEWARK, N. J.

### Annual Banquet and Educational Session

The Newark Branch of the American Electroplaters' Society will hold its annual banquet and educational session on Saturday, April 11, at the Elks Club, 1048 Broad Street, Newark.

The educational session will begin at 2:30 P. M. Anyone interested in electroplating or finishing may attend this session. Philip Sievering will preside, and the program will be as follows:

**The Cleaning of Metals,** by R. W. Mitchell, technical director, Magnus Chemical Company, Garwood, N. J.

**Odd Finishes, and Greens on Cadmium, Silver and Gold,** by F. J. MacStoker and H. H. Levine, members, New York Branch, A. E. S.

**Pewter, Its Manufacture and Finish,** by B. Egberg, chief metallurgist, International Silver Company, Meriden, Conn.

**Recent Developments of the Electrodeposition of the Metals of the Platinum Group,** by K. Schumpelt, metallurgist, Baker and Company, Newark, N. J.

The banquet is expected to be up to the usual high standard of former years, and all platers and their friends are urged to attend both the session and the banquet, which will begin at seven in the evening. The ladies will be with us, and there will be dancing after the dinner, as well as a program of entertainment.

Banquet Committee.

## American Society for Testing Materials

HEADQUARTERS, 1315 SPRUCE STREET, PHILADELPHIA, PA.

The standing committees of the American Society for Testing Materials will hold their Annual Spring Group Committee Meetings in Pittsburgh, Pa., beginning Monday, March 16, and extending through Friday, March 20. In conjunction with these, is the Regional Meeting, sponsored by the Society, which will be held Wednesday, March 18, taking up the greater part of the day. The following committees will hold meetings at which work in non-ferrous fields will be studied and discussed:

Sub-committee II, of B-5, on Cast Metals and Alloys.

B-7 on Light Metals and Alloys, Cast and Wrought.

## Association of Waste Material Dealers

HEADQUARTERS, TIMES BUILDING, NEW YORK CITY.

Dr. David Friday, one of the country's leading economists, is to address members and guests of the National Association of Waste Material Dealers, Inc., at its eighteenth annual banquet, to be held at the Congress Hotel, Chicago, Ill., on Wednesday evening, March 18. Dr. Friday's subject will be "The Outlook for Prices, Production and Profits."

## The Electrochemical Society

HEADQUARTERS, COLUMBIA UNIVERSITY, NEW YORK CITY

### Spring Meeting at Birmingham

The forthcoming Spring meeting of the Society will be held at the Hotel Tutwiler, Birmingham, Alabama, April 23, 24 and 25, 1931. The program arranged by the committee in charge, with Prof. S. J. Lloyd, Chairman, is so replete with attractive features that a very large attendance is anticipated. Members and their guests are urged to make room reservations as early as possible, addressing their request directly to the Hotel Tutwiler, which will be the headquarters of this meeting.

### Electrodeposition Division

Prof. A. Kenneth Graham, of the University of Pennsylvania and an associate editor of The Metal Industry, will conduct the meeting on electrometallurgy, Saturday morning, April 25. There will be papers on chromium, zinc, cadmium, calcium, lead, etc. A novel feature of this session will be the discussion on the electrodeposition of the noble metals, including those of the platinum group.

## Connecticut Non-Ferrous Foundrymen

HEADQUARTERS, CARE OF C. D. ELLIOT, WILCOX, CRITTENDEN COMPANY, MIDDLETOWN, CONN.

The Connecticut Non-Ferrous Foundrymen's Association was organized in the fall of 1930. Meetings have been held at the Hotel Garde, New Haven, Conn., the second Monday of each month, speakers on important foundry topics being heard, and discussions of a variety of subjects taking place at each meeting. Thus, in December, E. G. Jarvis, president, Niagara Falls Smelting and Refining Corporation, spoke on "Metals and Alloys"; in January, George Belknap, Belknap Manufacturing Company, Bridgeport, Conn., led a discussion of melting costs and furnace operation, being assisted by D. Tamor, metallurgist of Pratt and Cady Company, Hartford, Conn. At the February 9 meeting, Henry Spencer, of Lombard and Company, Boston, Mass., spoke on "Grinding Wheels and Abrasives." Attendance at each meeting has averaged about 30 foundrymen.

Officers of the Association for 1931 are: President, C. H. Blanchard, Pratt and Cady Company; vice-president, George Belknap; secretary, C. D. Elliot; treasurer, H. A. Phelps, Phelps Foundry Company, Ansonia, Conn.

The next meeting will take place March 9, when we will hear a representative of the New Haven Sand Blast Company, New Haven, Conn., speak on sandblasting as applied to the non-ferrous foundry. There will be a dinner and business meeting, beginning at 6:30 P. M., Hotel Garde, New Haven.

C. D. Elliot, Secretary.

## Brass Founders of New England

HEADQUARTERS, CARE OF G. W. THORNBURG, CRESCENT PARK BRASS FOUNDRY, WALTHAM, MASS.

Officers of the Associated Brass Founders of New England for the current year were elected at a recent meeting held by that group. George W. Thornburg, Crescent Park Brass Foundry, Waltham, Mass., was re-elected president. Other officers elected are as follows:

Vice-president: Howard A. Stockwell, Barbour-Stockwell Company, Cambridge, Mass.; Robert B. Bonner, Somerville Machine and Foundry Company, Somerville, Mass.

## British Institute of Metals

HEADQUARTERS, 36 VICTORIA STREET, LONDON, S. W. 1, ENGLAND

The Annual May Lecture will be delivered on Wednesday, May 6, by W. B. Woodhouse of the Yorkshire Electric Power Company. It will deal with technical and economic progress in the generation of electric power on a large scale.

A detailed programme has been issued of the visit that is to be paid to America next year by the Institute of Metals and the Iron and Steel Institute (both British). Full particulars of this plan and of the American trip generally can be obtained on application to G. Shaw Scott, secretary of the Institute of Metals, 36 Victoria Street, London, S. W. 1, England.

# Personals

## William Westerman

With a background of sixty-two years of service to metal industry, William Westerman, veteran brass and copper operating executive, brought to a close his long connection with the industry on January 1, 1931.

His advancement from apprenticeship with his father in the George Wostenholm Cutlery Works at Sheffield, England, to superintendent, manufacturing manager and consulting mechanical engineer of major brass and copper plants of this country is an outstanding example of the "cobbler sticking to his last" and an inspiration to the younger men of the industry of today.

WILLIAM WESTERMAN

Mr. Westerman made his bid for a position of high rank in the metal industry when as a boy he entered the employ of the Sheffield company in 1868. However, a short time later, he left the country of his birth to come to the United States and to Walden, N. Y., in 1872, where he accepted employment with the New York Knife Company, with which concern he remained for three years.

From 1875 to 1880 he was employed by the American Shear and Knife Company of Hotchkissville, Conn., and from 1880 to 1883 with the Excelsior Knife Company of Torrington, Conn., and during the latter period, at Wesleyan Academy, Wilbraham, Mass., he pursued studies which had been cut short in his earlier life.

In September, 1883, he entered the brass and copper field as a foreman in the finishing department of the Coe Brass Company, Torrington, Conn., under the superintendency of A. P. Hine, and continued there until 1896, when he was transferred to the company's branch at Ansonia, Conn., as plant superintendent. Here he remained until 1915, when he was engaged to supervise the building and organization, as well as manage, the newly constructed brass mill of the Western Cartridge Company at Alton, Ill.

He remained with the Western Cartridge Company for three years, and in 1918 became manufacturing manager for the Michigan Copper and Brass Company, Detroit, whe.e he was associated with D. M. Ireland, president, and the late A. B. Seelig, vice-president and general manager of the company.

The esteem and affection in which he was held by his co-workers and associates of Michigan Copper and Brass, as well as his ability as a producer, is indicated by the following verse, part of a poem written by a fellow shopman:

There is a man named William Westerman,
In the brass game he's the dean;
He was born in merry England,
Near Sheffield's lovely green.
He builds up broken brass mills;
He sets them on their way—
He gets the wheels aturning
And he makes the junk heaps pay.

Where those great rolls are turning,
And the brass is shining bright,
You can hear the clang of metal
From early morn till night.
Oh, it's there you'll find Old Billy—
Not very much to say,
But when he's on the warpath, boys,
There sure is hell to pay.

Don't tell him what you know, boys—
You know he has no peer—
For he's been round the brass game
For nigh on forty-five years.
So buckle in and work, boys,
When Old Billy comes along—
He sure will treat you right, lads,
And you'll miss him when he's gone.

Following a successful period of ten years at the Michigan Copper and Brass Company, the "dean" of the brass game, although at the time intending to retire, accepted the position of consulting mechanical engineer with the Rome Brass and Copper Company, now a unit of Revere Copper and Brass, and continued in that connection until January first of this year, when he definitely retired for a much needed rest. He has an enviable record of 48 years of intimate association with the brass and copper industry.

Mr. Westerman is spending the remainder of the winter with Mrs. Westerman at Orlando, Fla., and will return to Rome in the spring.

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**J. W. Valkenburg,** associated for five years with the Great Lakes Plating Company, Chicago, Ill., and for some years previously in the platers' supply business, has become identified with the sales department of Driscoll and Company, 1419 Carroll Avenue, Chicago, Ill., electroplaters.

**Thomas A. Wright,** technical director of Lucius Pitkin, Inc., consulting chemists and metallurgists, 47 Fulton Street, New York City, and a contributor to THE METAL INDUSTRY, has been appointed by President Hoover to membership on the United States Assay Commission for the year 1931.

**Wilfred F. McKeon,** president of Sulphur Products Company, and A. Fuller Company, Inc., both at Greensburg, Pa., makers of metal cleaners, is now at Miami, Fla., where he is spending two months. Mr. McKeon left Greensburg January 25, stopping at various points of business interest en route.

**E. D. Brauns** is in charge of the newly established Cleveland, Ohio, office of the Duriron Company, Inc., Dayton, Ohio. The office is at Room 528 Leader Building, Superior Avenue and East Sixth Street, Cleveland. It will supply complete sales service on the company's corrosion-resisting and other alloy irons and steels.

**Raymond K. Ford,** well-known in jobbers' circles throughout the southwest, has joined the field force of the McAleer Manufacturing Company, Detroit, Mich., and will operate throughout southern Texas. Before joining the McAleer organization Mr. Ford was connected with the Union Asbestos and Rubber Company, Chicago, Ill., The McAleer company manufactures polishes and cleaners.

**Edward Winters,** for the past 20 years with the American Brass Company, Waterbury, Conn., has resigned from the tube mill department of that company, where he was engaged as an expert in tube fabrication, and has taken charge of the tube mill of the Bridgeport Brass Company. In making the change, Mr. Winters follows the action of several other American Brass men, one of whom, **Ralph Day,** now manages the Bridgeport Brass Company.

**Illinois Testing Laboratories, Inc.,** 141 West Austin Avenue, Chicago, Ill., announces the appointment of **Ernest H. Du Vivier,** 30 Church Street, New York City, its representative in Metropolitan New York and northern New Jersey, and **F. W. Fernald** of 335 Fifth Avenue, Pittsburgh, Pa., as its representative in western Pennsylvania and West Virginia, for its line of portable and stationary pyrometers, resistance thermometers and other industrial measuring instruments.

# Obituaries

## Howard Evans

Howard Evans, for more than 50 years connected with the J. W. Paxson Company, Philadelphia, Pa., and vice-president and a director of that company, died at the age of 78, on January 21, 1931. Mr. Evans was secretary of the Philadelphia Foundrymen's Association for 37 years. He was also president of Penn Facing Mills Company, Irwin, Pa.

HOWARD EVANS

Mr. Evans' entire business life was spent with the foundry supply house of which he became a director and vice-president. The foundry industry at Philadelphia owes a great deal to his energetic activities in its behalf. He was one of the founders of the association which he served as secretary for 37 years up to 1929. He also did the preliminary secretarial work in the organization of the American Foundrymen's Association in 1896, and from 1896 to 1900 was its treasurer. He was acquainted with thousands of foundrymen throughout the country, and was universally admired for his integrity and genial personality.

Mr. Evans was unmarried and for many years made his home at the Union League Club, Philadelphia. He was also a member of the Philadelphia Manufacturers Club.

## Sir Charles A. Parsons

Sir Charles A. Parsons, of London, England, famous inventor and metallurgist, died February 12, 1931, while on a West Indies cruise. He was 76 years old.

While his greatest invention was the modern turbine, Sir Charles Parsons is also credited with an important metallurgical advance, the invention of Parsons' manganese bronze, which was for some years after its invention the standard manganese bronze alloy.

## James A. Morrison

James A. Morrison, up to three years ago president of the James Morrison Brass Manufacturing Company, Ltd., Toronto, Canada, died at that city on January 26, 1931, after a year's illness.

Mr. Morrison succeeded his father, the late James Morrison, as head of the company bearing their name, and remained in the office of president until the company was sold, three years ago, to a group of Canadian financiers, who now operate it.

## Henry A. Hammond

Henry A. Hammond, for many years New York representative of the General Cable Corporation, New York, died at that city January 1, 1931. He was 58 years of age. For many years he was connected with the Rome Wire Company, which became a division of General Cable Corporation a few years ago. He was with these firms for 27 years in all.

## W. P. Scott

W. P. Scott, of Philadelphia, Pa., for many years an active member of the metal cleaning and finishing supply industry, died in that city last month in his fifty-second year.

W. P. SCOTT

Mr. Scott was best known as industrial service representative of the J. B. Ford Company, of Wyandotte, Mich., manufacturers of metal cleaners, whom he served for 15 years and 7 months in the Philadelphia district. He was their first industrial representative, and held an enviable position in the estimation of his associates as well as the industry he served. Mr. Scott was especially well known for his many years of activity in the Philadelphia Branch of the American Electroplaters' Society. He is survived by his widow, Mrs. Clara B. Scott.

## Archibald Bannatyne

Archibald Bannatyne, 78, originator of the famous dollar watch that played such an important part in the growth of the Waterbury Clock Company and its later subsidiary, the Ingersoll Watch Company, died at his home in Naugatuck, January 29.

Mr. Bannatyne entered the employ of the Waterbury Clock Company at the age of 25, and in 1890 originated the first dollar watch, called "The Jumbo." The Ingersoll company saw it on the market and, coming to Waterbury, made an agreement with the Waterbury Clock Company to take the entire watch output, after which it was named the "Ingersoll Watch."

Many years later the Waterbury Clock Company acquired the Ingersoll Company and the New England Watch Company, formerly the Waterbury Watch Company, which had also turned out a low priced watch. After 28 years with the Waterbury Clock Company, Mr. Bannatyne resigned to start the Bannatyne Watch Company, which was later sold to the Ingraham Clock Company of Bristol. In 1912 he became connected with the Ansonia Clock Company, of Brooklyn, N. Y., and retired about 10 years later.

## Rudolph Bauerle

Rudolph Bauerle, Sr., Philadelphia, Pa., formerly a member of the firm of Bauerle and Morris, Inc., machinery manufacturers and producers of copper and brass work, died suddenly on January 9, 1931, aged 81 years. Mr. Bauerle retired from business eleven years ago.

## Ray L. Lambert

Ray L. Lambert, vice-president of the Lambert Art Metal Company, Inc., Columbus, Ohio, died there recently. He was 44 years of age.

# News of the Industry

## Industrial and Financial Events

### Ajax Electric Furnace Corporation

The Ajax Electrothermic Corporation, Trenton, N. J., the division of The Ajax Metal Company which manufactures and exploits the Ajax-Northrup high frequency coreless induction method of heating, has from the beginning operated as a separate company, but largely controlled by The Ajax Metal Company, Philadelphia, Pa. The Ajax-Wyatt Division, which has manufactured and exploited the Ajax-Wyatt submerged resistor induction type furnace, has up to this time operated merely as a department of the metal company. It is now intended to divorce the Ajax-Wyatt Electric Furnace Division and accordingly a separate company, Ajax Electric Furnace Corporation, has been incorporated and organized for the purpose of carrying on the activities in the line of submerged resistor induction electric furnaces.

It is the intention of the new company to continue the exploitation of its furnaces to meet the demands for increased capacity in the wrought brass field and to exploit them also for brass foundry use, where the conditions are such as to make this type of furnace advantageous. It is intended also to enter other fields where core type induction can be advantageously used.

The company is incorporated with a stock structure of 2,000 shares of 8% cumulative preferred stock and 2,000 common shares. At the organization meeting the following officers of the company were elected: G. H. Clamer, president and general manager; James R. Wyatt, vice-president in charge of manufacturing and development; Henry Gieseke, secretary (in charge of sales); E. Allen Ginkinger, treasurer (in charge of finance and accounting). The company will occupy its newly completed building on Frankford Avenue, Philadelphia, Pa., near the main plant of The Ajax Metal Company.

### New Uses for Metals

International Nickel Company, New York, announces the manufacture of Monel metal kitchen sinks for household use. About a million household sinks of all kinds are sold annually in the United States. In making its bid for part of this business, the company points out that the Monel product withstands hard usage without chipping, cracking or discoloring. The sinks will be marketed by direct contact with house-equipping organizations.

Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., is preparing to make tests in actual practice of the use of aluminum frames for 200 horsepower single-phase motors for electric railway traction. It is believed that a saving of 600 to 1,000 pounds can be effected by supplanting iron with aluminum in this application.

### McAleer Manufacturing Company

McAleer Manufacturing Company, Detroit, Mich., producers of cleaners and polishes, report continued full operation of their plant, with prospects for business steadily improving. C. H. McAleer, head of the company, who has just returned from an 8,000-mile air tour of the south and southwest, announced that business of his company in 1930 was triple that of 1929, and that in his estimation 1931 would be about double the 1930 volume.

### Sargent and Company Buys Plants

Sargent and Company, New Haven, Conn., manufacturers of small hardware, announced last month their acquisition of the Belleville Hardware and Lock Manufacturing Company, Limited, of Belleville, Ont., Canada. The new Canadian branch will be known as Belleville-Sargent and Company, Ltd., and will continue to operate at Belleville.

### Ajax Electric Company, Inc.

Under the above name a new company has been organized to develop and exploit electric resistance heating equipment. The Electric Resistance Furnace Company, subsidiary of the Electric Furnace Company, Ltd., of Great Britain, has developed quite an extensive line of electric resistance heating equipment which the new company intends to exploit in this country.

The Electric Furnace Company, Ltd., has been associated with The Ajax Metal Company and with the Ajax Electrothermic Corporation for a great many years, that company having exploited the sale of Ajax-Wyatt and Ajax-Northrup equipment throughout the British Empire and in France and Belgium.

The plant of the Ajax Electric Company, Inc., will be located on the corner of Frankford Avenue and Allen Street, Philadelphia, Pa., just across the street from the main plant of The Ajax Metal Company. The stock structure of the new company will be 1,000 shares 8% cumulative preferred stock and 1,000 no par common shares. The officers elected at the organization meeting were the following: G. H. Clamer, president; William Adam, Jr., vice-president; John E. Haig, secretary; E. Allan Ginkinger, treasurer.

### Ajax Metal Company Aids Revival

At the January meeting of the board of directors of The Ajax Metal Company, Philadelphia, Pa., it was decided to proceed with plant improvements and extensions which have been contemplated for some time. Decision to proceed at the present time was due to three considerations: Present low cost of building; to have the extensions and improvements ready for the business revival; and because it was thought that this would be a little constructive step in relieving the unemployment situation and re-establishment of industrial confidence.

The plant extension will take the form of a two-story annex, covering the entire triangular-shaped block to the south of the present buildings. Plant will be used primarily for receiving and storing raw materials, and will be equipped with latest devices, making possible handling of materials with greatest dispatch, efficiency and economy. Cost of this plant extension will be $300,000.

If similar steps to the greatest extent possible were to be taken by many others, the employment problem would not long be with us and confidence would be restored, the company believes.

### Tabor Company Buys Titgen-Eastwood

The Tabor Manufacturing Company, Philadelphia, Pa., manufacturers of foundry molding machines, has acquired the goodwill, patents and personnel of the Titgen-Eastwood Company, manufacturer of cupolas, sandblast equipment, furnaces, tumbling barrels, blowers, dust collectors, core room accessories, etc., as well as acting as agents for repairs and parts for the L. W. Paxson Company line of foundry equipment. The Tabor company will now supply all Titgen-Eastwood products and also perform its services as regards the Paxson line. Messrs. Titgen and Eastwood have been retained as well as the rest of the acquired company's personnel.

### Brass Ingot Statistics

Non-Ferrous Ingot Metal Institute, Chicago, Ill., reports the average prices per pound received by its membership on commercial grades of six principal mixtures of ingot brass during the twenty-eight day period ending January 30, as follows: 80-10-10 (1% impurities), 10.818c; 78%, 9.726c; 81%, 9.545c; 83%, 9.881c; 85-5-5-5, 10.071c; No. 1 yellow brass, 7.844c.

The combined deliveries of brass and bronze ingots and billets

by the members of the Institute for the month of January amounted to a total of 5,261 tons.

On February 1, unfilled orders for brass and bronze ingots and billets on the books of the members amounted to a total of 23,415 net tons.

## Silverware Plant Swept by Fire

The plant of the Hartford Sterling Company, Fernwood, Pa., manufacturers of silverware on March 5, was swept by a fire estimated to have damaged the building and equipment to the extent of $200,000. The blaze originated on the third floor and gutted the upper floors of the factory before it could be checked.

E. L. H.

## European Aluminum Cartel

Reports from abroad indicate the possibility of a break in the European Aluminum Cartel, which controls prices and production of the metal there, due to a dispute which has arisen between German and Swiss producers over quotas.

## Corporation Reports

**Canadian Bronze Company,** Ltd.: net income for 1930, after charges and taxes, $308,792, compared with $471,997 in 1929.

**Doehler Die Casting Company,** New York: net income for 1930, $142,430 after charges, against $768,343 for 1929.

**Link-Belt Company,** Chicago, Ill.: net income for 1930, $2,310,332, against $3,484,686 for 1929, both after charges.

**National Lead Company,** New York: 1930 net earnings, $4,675,098 after charges, equal to $7.58 a share on common stock; dividend rate of $5 maintained.

**General Bronze Corporation** and subsidiaries, New York: net loss for 1930, $969,299 after charges, as against net income of $1,128,464 in 1929.

**Ohio Brass Company** and subsidiaries: 1930 net profit after depreciation, Federal taxes and inventory write-down, $1,817,518, compared with $2,823,057 in 1929.

**American Silver Company,** Bristol, Conn.: Edward Ingraham has been elected a director, to fill vacancy caused by death of his father, W. S. Ingraham. Officers were re-elected.

**Canada Wire and Cable Company,** Toronto, Ont.: net income for 1930, $685,743 against $890,726 in 1929, both after charges.

**General Cable Corporation,** New York, and subsidiaries: net loss for 1930, $2,067,951, against net profit of $4,709,160 for 1929, both after all charges. Loss was attributed in part to abnormal decline in copper and other raw materials.

**United Engineering and Foundry Company,** Pittsburgh, Pa.: net earnings for 1930, approximately $2,000,000, against $1,671,887 for 1929. Company reported excellent backlog of machinery business, and a number of sizeable machinery projects being estimated on.

**Bristol Brass Corporation,** Bristol, Conn.: At the annual meeting of stockholders last month, D. S. Ingraham of E. Ingraham Company, and F. M. Siebert, Waterbury, Conn., sales manager of Bristol Brass Corporation, were elected directors of the Bristol Brass Corporation, to fill vacancies caused by deaths of W. S. Ingraham and J. R. Holley. Officers of the company were re-elected at a subsequent meeting of directors.

**Revere Copper and Brass** voted to omit the quarterly dividend of $1 a share on the class A stock, but declared the regular quarterly of $1.75 a share on the preferred issue. C. D. Dallas was elected president; F. H. Bronnell, chairman of the finance committee; Barton Hazelton, chairman of the board; George Allen, chairman of the executive committee; William Peirce, first vice-president; George F. Stanton, vice-president and sales manager; J. A. Doucett, vice-president and assistant sales manager.

## Incorporations

**R. L. Davis Electric Company, Inc.,** Wallingford, Conn., has been incorporated with $50,000 capital. Company provides an engineering service to wire manufacturers, and is having outside firms make some of the equipment it furnishes to the wire industry, such as spark testing and automatic depanning and reeling apparatus. **Ralph L. Davis** heads the company.

**Aluminum, Brass and Copper Works, Inc.,** Newark, N. J., care of William H. Parry, 9 Clinton Street, attorney, recently organized with capital of $100,000, plans operation of local factory for the manufacture of metal goods, including plumbing specialties. The company is headed by **William J.** and **Walter W. Filipowicz.** The following departments are operated: brass, bronze and aluminum foundry; brass machine shop, tool room, spinning, tinning. The company also specializes in the manufacture of chemical plant accessories of copper and brass.

**Cox-James Company,** Grand Rapids, Mich., has been organized to take over and consolidate **H. F. Cox Company** and **C. C. James Company,** both of Grand Rapids, manufacturers of metal building products, roofing, etc. The new company will be capitalized at $150,000, and will carry out development program. Departments are operated: cutting-up shop, stamping, zincing, tinning, soldering, polishing, japanning.

**Charles Wegelin** and **Louis Callot,** formerly vice-president and secretary, respectively, of **Dixie Brass and Foundry Company, Inc.,** Birmingham, Ala., have organized a new corporation known as the **Dixie Bronze Company, Inc.,** and will operate the plant of the former company under that name. **Charles Wegelin** is president and treasurer and **J. E. McAllister** is secretary. The company operates the following departments: brass, bronze and aluminum foundry; brass machine shop, plating, polishing, grinding room, lacquering.

# Business Reports of The Metal Industry Correspondents

## New England States

### Waterbury, Connecticut

MARCH 2, 1931.

**American Brass Company** officers have been reelected as follows: president, John A. Coe; vice-president, Clifford F. Hollister; vice-president, Clark S. Judd; treasurer, Clifford F. Hollister; assistant treasurer, Major W. Judge; assistant treasurer, S. Burnham Terry; assistant treasurer, Edwin J. Rockwell; secretary, Clifford F. Hollister; assistant secretary, Edwin J. Rockwell. The assistant secretary is a new appointment.

**Waterbury Buckle Company,** officers have been elected as follows: president and treasurer, Julius B. Smith; secretary, Jerome R. LaVigne.

**R. W. Reid,** former vice-president and general manager of the **Beardsley and Wolcott Manufacturing Company,** was elected president of the company at the annual meeting last month, succeeding **Mason T. Adams,** who as president of the **Seth Thomas Clock Company** has found his duties so increased that he is unable to continue with the local concern. Other officers elected are: treasurer, Francis T. Phillips; secretary, Rowley W. Phillips.

**Austin L. Adams** has been elected a director of the Bristol **Company** in place of the late **W. H. Bristol.** Officers were elected as follows: president, Howard H. Bristol; first vice-president, Carlton W. Bristol; second vice-president, H. L. Griggs; third vice-president, Herman Koester; secretary-treasurer, Harris Whittemore, Jr.

**United States Fastener Company** of Boston has brought suit for $3,000 damages against John Draher, George F. Pullen, G. Alton Pullen and Max Kiesling, all former directors of the **Waterbury Fastener Company,** which was purchased

March 16, 1929, by the Plaintiff. The plaintiff claims that the defendants in selling the Waterbury Fastener Company signed an express warranty that the assets and liabilities of the company were as shown in a certain statement and that plaintiff bought it and obligated itself to pay all the indebtedness as shown on the statement; that the actual accounts payable were $2,441.06 in excess of amount stated by defendants and that plaintiff was obliged to pay this.

**Reising Arms Company** may locate a plant here for the manufacture of a .22 calibre automatic gun.

**Shoe Hardware Company** officials deny persistent rumors that the plant is preparing to close down or move out of town, although admitting that 28 men were recently laid off.

The interior of the hardening plant of the **Waterbury Steel Ball Company** was completely destroyed and the machinery ruined by a fire February 3. Damage was estimated at $25,000.

**Frederick S. Chase,** president of the **Chase Companies, Inc.,** was the toastmaster at the annual dinner of the Chase Foremen's Association last month.

**Correction**

**Chase Companies, Inc.,** deny that the pay of their salaried men was cut during 1930 as was reported in the review of the year published in our January issue.

W. R. B.

## Connecticut Notes

MARCH 2, 1931.

**HARTFORD—General Sanford Wadhams** of the State Water Commission, speaking on the powers of the commission before the appropriations committee of the legislature last month, declared that the rigid enforcement of the commission's powers to order elimination of river pollution would force the closing of every brass factory in the Naugatuck River section. He said the commission is proceeding slowly, and many of the plants are working on plans to secure the elimination that the Commission has power to insist upon. He believes they will effect this without a positive order from the Commission.

**Colt's Fire Arms Company** has declared a quarterly dividend of 37 cents a share, payable March 31 to stock of record March 12.

**Philip Wagoner,** president of the **Underwood-Elliott-Fisher Company,** announces the appearance of a new portable typewriter model. The company's plant at Bridgeport is running full time on its production, he states.

**Veeder-Root, Inc.,** paid the regular quarterly dividend February 16. Its report for last year showed net earnings of $1.85 a share although $2.50 a share was paid. **President John T. Chidsey** said 1930 sales were 33 per cent below 1929 but that a pick-up was noted in December, and business on the books February 1 showed a 20 per cent increase over January 1 and a 40 per cent increase over December 1.

**Arrow-Hart and Hegeman Electric Company** had a net income of $522,529 last year and paid dividends to the amount of $724,959. **President E. R. Grier** said that a wage cut of 5 per cent and a salary cut of 10 per cent would have made up the shortage in dividend requirements. Two new directors were elected: **John R. Cook and Harvey C. Pond.** Mr. Cook is general manager of the company and Mr. Pond is general sales manager. Officers elected: president, E. R. Grier; vice-presidents, S. P. Williams, B. C. Perkins, Monroe Guett, J. R. Cook, H. C. Pond; treasurer, T. A. Inch; assistant treasurer, C. A. TenEyck; secretary, E. Bosworth Grier; assistant secretary, W. H. Harrington.

**BRISTOL—Bristol Brass Corporation** at its annual meeting last month reported a surplus of $825,684, compared with $853,101 a year ago. However, the financial position was improved during the year by paying off all bank loans and acquiring $200,000 worth of its outstanding preferred stock. It had cash on hand at the end of the year of $533,451. **Dudley S. Ingraham** and **Frederick M. Seibert** were elected directors in place of the late **Edward Ingraham** and **E. L. Holley.** Officers elected: president, Alex Harper; vice-president and treasurer, A. D. Wilson; vice-president, C. T. Treadway; secretary, H. N. Law; assistant treasurer, C. A. Gustafson.

At the annual meeting of the **American Silver Company** last month, **Edward Ingraham** was elected to the board of directors to take the place of his father, **W. S. Ingraham,** deceased. Officers elected: president, Alex Harper, who was also chosen treasurer and manager; vice-president, Dean Welch; secretary, George M. Merriman; assistant treasurer, John J. Kaicher.

**NEW BRITAIN—**Members of the **National and Connecticut Foundrymen's Association** held an all day session at the State Trade School here last month. Talks were made by **Dr. Harry Myers** of the **Frigidaire Company, A. D. Lynch,** and **L. W. Olson** of Mansfield, Ohio.

**Stanley Works** charter amendment to permit the purchase of stock of the company up to 10 per cent for resale to employes has been adopted by the legislature.

**P. and F. Corbin Division** of the **American Hardware Corporation** celebrated its 75th anniversary last month. It began business with $600.

**Charles Parsons,** vice-president of the American Hardware Corporation and general manager of the P. and F. Corbin Division, has secured the use of a building adjoining the company offices for the use of the Foremen's Club and the Girls' Club of the company.

**Goss and DeLeeuw Machine Company** has given notice of its intention to increase its capital stock from $250,000 to $300,000. Additional stock will be sold at $25 a share.

**MERIDEN—International Silver Company** at its meeting last month voted to omit the quarterly dividend on the common stock but voted the preferred dividend of 1¼%, payable April 1. The company has developed a new silverware finish known as "Palladiant." The process is said to give sterling silver a finish that does not need to be polished.

**Miller Company** has placed foreign manufacturing rights for the company's "Duplexalite" products in France with the **Compagnie Des Lampes** of Paris. Sales rights in France, Spain, Portugal, Greece, Czecho-Slovakia and Poland are also granted.

**TORRINGTON—**Although the **Hendey Machine Company** greatly reduced its office force and drafting departments and put the entire plant on a 32-hour week early last month, it increased the schedule to 45 hours a week before the end of the month. Officials deny that the concern will close and point out that between 90 and 100 of their old employes who were let out about Christmas have been hired back. Although the company has lost most of its business in selling tools and machinery to Russia, it is planning a new sales program in this country and elsewhere.

**P. J. Fitzgerald,** president of the **Fitzgerald Manufacturing Company** denied reports current last month that the concern is paying its girl employes only 11, 12 and 13 cents an hour for a 10-hour day, and its men employes but 25 cents an hour. He said the stories emanated from rivals who were envious of the fact that the company has been working at full capacity for some time and has been hiring on employes while other plants have been laying them off.

**Union Hardware Company's** tube and shaft departments, which have been running overtime for more than a month with both day and night crews, have now been put back on a five-day week. They have been busy making golf shafts.

**NEW HAVEN—**Directors of the **New Haven Clock Company** have declared the regular quarterly dividend of $1.62½ on the preferred stock, payable March 2.

**WINSTED—**Officers of the **William L. Gilbert Clock Company** were elected last month as follows: President, Norman F. Thompson, Jr., vice-president, Ralph E. Thompson; vice-president in charge of sales, Norman L. Stevens; vice-president in charge of production, Othnell G. Williams; secretary and treasurer, R. J. Leighton.

**STAMFORD—Yale and Towne Manufacturing Company** has declared the regular quarterly dividend of 50 cents, payable April 1 to stock of record March 11. The company announces it will concentrate on lock and hardware production at the local plant and will transfer the lock manufacturing of the Philadelphia plant to Stamford. The company's executive offices will be moved from Stamford to New York, and two departments from Stamford and the production equipment at Cincinnati will be moved to Philadelphia. About $1,000,000 worth of equipment will be moved from this city. The work will take about three months. Approximately 125,000 square feet will be vacated.

**BRIDGEPORT—The Bridgeport Brass Company** has opened a sales office at Dallas, Texas, with **W. C. Hummelbough** in charge.

W. R. B.

### Providence, Rhode Island

March 2, 1931.

Never in the history of Rhode Island has there been such a general industrial depression as during the past month. There is a larger percentage of wage earners out of employment than ever before, and many industrial plants are practically closed. With approaching open weather and the furtherance of numerous construction projects it is hoped, however, that the situation will improve in the near future. Metal lines of every description have suffered, but brighter days are looked for.

Stockholders of the **Nicholson File Company,** at the annual meeting, elected the following officers: president and general manager, **Samuel M. Nicholson;** vice-president and treasurer, **Paul C. Nicholson;** secretary and assistant general manager, **Ernest S. Craig.**

**American Screw Company** in 1930 earned, after dividends and charges, approximately $155,275, it is estimated from the company's balance sheet

**C. Mancini and Son, Inc.,** has been incorporated under the laws of Rhode Island to conduct a jewelry business, with an authorized capital of 100 shares of common no par value stock. The incorporators are: **Novello A. Mancini,** Camillo **Mancini** and **Carl Testa,** all of Providence.

A creditors' petition in bankruptcy was filed February 18 in the United States District Court at Providence against **Arsen G. Avedisian,** doing business as the **Providence Brass and Aluminium Foundry.** No schedule of assets or liabilities was filed, but the petitioning creditors and the amount of their respective claims were: **Benjamin Zura,** Providence, $186.48; **Whipple and Choate Company,** Bridgeport, Conn., $365.44; **The Outlet Company,** Providence, $522.39.

W. H. M.

# Middle Atlantic States

### Central New York

March 2, 1931.

While the expected spurt in activities among the nonferrous industries in the Central New York area failed to materialize in February, factory officials assumed a semi-optimistic attitude, due to the fact that the down hill trend in the general industrial report for the area slowed up considerably, with only a drop of two per cent in employment shown against an average of about five per cent for previous months.

At the office of the Industrial Association of Utica, where employment figures for New York State are compiled, it was reported that the copper and brass industries in the Rome area marked time last month, with no sign of increase.

**Bossert Corporation,** Utica, revealed a slight increase in activity over last month. **Foster Brothers Manufacturing Company** report adding a few men to their force, but **Savage Arms** reported no increase in activity.

**Irving L. Jones** on February 26 was elected president of the **International Heater Company,** to succeed **Frank E. Wheeler,** who died recently. Mr. Jones has been treasurer of the company and has been connected with the concern since 1898 when it was organized. **Beecher M. Crouse** was elected a director to take the place of Mr. Wheeler.

**W. E. Scanlan,** credit man for the **Oneida Community, Ltd.,** attracted attention on February 24 when he addressed the state convention of **Retail Credit Grantors** at Utica. He asked credit managers what their decision would be "if a clergyman receiving $1,000 a year asked for $1,500 credit, or if Al Capone asked for it."

In trend with the demand for welding in industry **Horace B. Griffith,** assistant superintendent of the Utica schools, has started a class in welding at the Utica Free Academy.

E. K. B.

### Newark, N. J.

March 2, 1931.

**General Seal and Lock Corporation,** 625 Devon Street, Arlington, has leased a part of the Lefcourt Building, Newark, for the establishment of a sales office. **T. George Stiles,** president, says the concern has begun an expansion program.

**Searles Manufacturing Company,** makers of bathroom fixtures, of 27 Mulberry Street, will move to 161-69 Ogden Street. The company has leased the property for a term of years.

**Eastman Chemical Company's** plant at Passaic Junction has been sold to the **T. A. Gillespie Company.** The Eastman Company is a subsidiary of the Eastman Kodak Company of Rochester, N. Y. The plant is near Paterson and extends for 700 feet. It comprises 13 acres of land. The Gillespie company will use the property for storage purposes and will later build a manufacturing plant there.

Insolvency proceedings against the **Eastern Aeronautical Company,** have been dismissed by Vice-Chancellor Church. Claims against the company have been settled.

**John T. Grammer** has been appointed temporary receiver for the **Burroughs Company,** with a plant at 246 North Tenth Street. Petition for the receiver was made by the secretary of the company, who is a creditor for $3,490. It is alleged the company, which was incorporated to manufacture hydraulic machinery and tools, has been operating at a loss and the 1930 income taxes are still unpaid. The assets are said to be in excess of $200,000.

The following Newark concerns have been incorporated: **Royal Silver Manufacturing Company;** 100 shares no par; to manufacture silverware. **Reo Chemical Company;** $100,000 capital; manufacture chemicals. **Klipstein Chemical Process, Inc.;** 999 shares no par; chemicals. **J. Sussman and Son,** Inc.; $100,000; manufacture hardware.

C. A. L.

### Trenton, N. J.

March 2, 1931.

The metal plants here continue to operate below normal and manufacturers are not encouraged over the outlook. The **Roebling Company** and the **J. L. Mott Company** are not running on full time. However, Roebling continues to enlarge its huge plant. The company recently let a contract for an addition to the Woolverton Avenue factory, to cost $24,000.

**Edmund Roebling,** last surviving son of John A. Roebling, builder of the Brooklyn Bridge, left upon his death an estate consisting of cash and securities valued at $13,393,725. He held 34,500 shares of the **John A. Roebling's Sons Company.** Mr. Roebling was formerly a member of the Roebling firm here.

The corporate existence of the **New Jersey Wire Cloth Company** has been terminated, the business being continued by the **John A. Roebling's Sons Company.** The Roebling company has assumed all contracts and obligations of the New Jersey Wire Cloth Company, while the same personnel will continue the manufacture and sale of the entire line.

The following concerns have been incorporated here: Fred **Del Sordo, Inc.;** to manufacture radio tubes; 1,000 shares, Union City, N. J. **King Jewelry Company, Inc.;** manufacture jewelry, $125,000, Camden. **Jackson Metal Co.,** metals, 100 shares, Jersey City. **Central Novelty Company, Inc.;** manufacture cutlery; $5,000; Englishtown. **Horlbeck Metal Crafts, Inc.;** metal products; $125,000; Union City. **A-S-P Chemical Products Company;** chemicals; 2,500 shares; Westwood.

C. A. L.

# Middle Western States

## Detroit, Michigan

MARCH 2, 1931.

Manufacturing is not as vigorous as was expected several weeks ago. The great plants in the Detroit area are still on greatly curtailed schedules. Some are operating three and four days a week, and there are cases where nothing is doing at all.

**Copper and Brass, Inc.,** with headquarters at Jefferson and McDougall Avenues, Detroit, is a new Michigan concern. The capital stock is $12,000 and the owners are **Sherman J. Fitzsimmons, Sr., Sherman P. Fitzsimmons, Jr.,** and **Harry B. Howenstein.**

Announcement is made that the stove manufacturing industry in Detroit is all set to do things during 1931. Having brought an array of exceptionally smart models featuring many striking finishes, stove makers are engaged in an ambitious merchandising effort, employing the aggressive tactics of the motor car companies. The sales campaign, departing from the usual emphasis on utility, rests its appeal this year on woman's love of fine furniture, and it must be said that the kitchen stove 1931 model is a most attractive article. Naturally, a good deal of electroplating is involved in this line of manufacture.

**Detroit Plating Industries,** incorporated here in 1916, is specializing in "Sherardizing," a rust-proofing process. Detroit Plating Industries, a few years after organizing patented the acorn or cap nut, which is used extensively in the automotive, aircraft and other industries.

January sales of the **C. M. Hall Lamp Company** were 33 per cent greater than those of December, according to a recent report. February showed an approximate gain of 50 per cent, it is stated, while March releases indicate a 35 per cent gain over February.

F. J. H.

## Toledo, Ohio

MARCH 2, 1931.

General manufacturing conditions are showing a gradual upward trend in this area. This applies, of course, to other lines as well as those relating to non-ferrous metals and plating. Toledo has varied lines of industries that are not all affected alike when it comes to a period of depression. Many of these industries operate their own plating plants. Some very encouraging reports are now coming from them.

All eyes, of course, are centered on the motor car industry. In Toledo the accessory industry is largely concerned. Of late there has been a gradual upward trend. However, none are operating at capacity, although some report orders ahead that will keep them busy for a considerable time.

Automobile manufacturers this year will produce only what can be absorbed from month to month. There will be no cars manufactured for stock, as has been the custom of other years. Operations, it is very evident, are scheduled according to a hand-to-mouth policy.

Manufacture of plumbing and steamfitting supplies shows no marked upward trend as yet. The building industry in the Great Lakes area is still in a very depressed condition.

F. J. H.

## Wisconsin Notes

MARCH 2, 1931.

**Robert G. Suettinger,** Two Rivers, Wis., was elected president of the Sheet Metal Contractors' Association at its annual convention at the Pfister Hotel, Milwaukee, February 3. Other officers are **Louis Reinke,** Milwaukee; **George Bishoff,** Marinette; **William Gerke,** Sheboygan; **James Birthrong,** Waukesha and **Adolph Shumann,** Milwaukee, vice-presidents; **Paul Biersach,** Milwaukee, secretary; **Alfred C. Goethel,** Milwaukee, treasurer and **C. F. Goldstone,** Menominee, Mich., sergeant-at-arms.

**Philip Kempter,** 64, works manager at the **Geuder, Paeschke and Frey Company,** Milwaukee, for many years, died January 26 at his home in that city after an illness of two years. Born in Galena, Ill., Mr. Kempter came to Milwaukee 33 years ago to become associated with the Geuder, Paeschke and Frey.

A step-up in manufacturing activities has been reported by the **Aluminum Goods Manufacturing Company,** operating plants in Manitowoc and Two Rivers. The company's three plants are now operating on a full time basis, with the employment of 4,500 men. For the last year the aluminum plants have been working only from four to five days a week. They are now operating nine hours a day and Saturdays.

Within several weeks bar aluminum has been stolen from the plants of the **Wisconsin Pattern Works** and the **Racine Aluminum and Brass Company,** of Racine. Six hundred pounds of aluminum in bars was stolen recently from the Wisconsin Pattern Works, and prior to that 700 pounds of aluminum bars were taken from the Racine Aluminum and Brass Company. Entrance in both cases was gained through a rear window.

A. P. N.

# Other Countries

## Birmingham, England

FEBRUARY 20, 1931.

A detailed program has been issued of the visit that is to be paid to America next year by the **Institute of Metals** and the **Iron and Steel Institute.** These two international bodies have been invited by the **American Institute of Mining and Metallurgical Engineers** to hold their respective autumn meetings in New York in September, 1932, the meetings to be followed by a tour in United States and Canada in the course of which many cities and industrial plants will be visited.

The metals group at the **British Industries Fair** held at Castle Bromwich from February 16 to 27 included a very full representation of British products in ferrous and non-ferrous materials. It is hoped that a stimulus will be given to these trades by the Fair. Business has been rather slow since the year opened. Brass and copper tubes have been falling in price and consequently buyers hold off the market as long as possible, making purchases at the last moment.

Some lines are busy, notably the gas fittings and certain branches of the electrical industry. Cabinet brassfoundry is quiet, owing to the slowing down of building operations during the winter months. It is hoped, however, that with the Spring this demand will improve. Many municipalities are grappling with housing problems and intend to proceed with the erection of houses at a rapid rate.

The demand for copper tubes for domestic water conveyance has been a feature of the tube trade which has helped to sustain the industry in the present depression. Users have been educated up to the value of these tubes on account of their long life and resistance to corrosion.

Makers of aluminum hollow-ware are maintaining a steady output and this trade has not been so badly hit as some others in the present depression. The loss of Australia as a market has been keenly felt, but manufacturers are hoping to replace this trade by increased exports to other parts of the world.

J. A. H.

# Business Items—Verified

**Bridgeport Brass Company,** Bridgeport, Conn., has established a brass sales office at Dallas, Texas, with **W. C. Hummelbough** in charge.

**The Pyrometer Instrument Company,** New York City, has removed to 103 Lafayette Street, from its former location, 50-52 Howard Street.

**Apex Electrical Manufacturing Company,** Cleveland, Ohio, has acquired the refrigerator business of the **Wayne Home Equipment Company,** Fort Wayne, Ind.

**American Smelting and Refining Company,** New York, has awarded general contract for a 30,000 addition to its plant at Omaha, Neb. The firm states it is not in the market for equipment.

**Searls Manufacturing Company,** 27 Mulberry Street, Newark, N. J., manufacturer of bathroom fixtures and equipment, has leased property at 161-167 Ogden Street, for a new plant for increased capacity.

**Electro-Platers Technical Institute,** 619 Wellington Avenue, Chicago, Ill., headed by **W. C. Ferris,** reports it has inaugurated a new policy of time payments for courses, as well as a reduction in price.

**Duriron Company,** Dayton, O., has opened a Cleveland branch office at Room 528 Leader Building, Superior Avenue and E. 6th Street, in charge of **E. D. Brauns,** supplying complete sales and service.

**Calorizing Company,** Wilkinsburg, Pa., manufacturers of calorized steel, heat and corrosion resisting metals, has awarded contract for a 2-story, 96 x 132 ft., foundry and pattern storage building.

**Griffis-Hayes Foundries, Inc.,** Galva, Ill., has been organized by **H. E. Anthony** of Galesburg, Ill., and others, to manufacture metal castings. Capital is $50,000. Brass, bronze and aluminum foundry, polishing and grinding departments will be operated.

**Alpha Metal and Rolling Mills, Inc.,** 363 Hudson Avenue, Brooklyn, N. Y., handle Britannia metal, pewter, and white metal alloys. **L. T. Cleary** is president, and **Frank Stise** is secretary and treasurer. Both have had over 25 years' experience in the metal business.

**American Coolair Corporation,** 3604 Mayflower Street, Jacksonville, Fla., has installed a modern foundry for brass, aluminum and cast iron. The foundry will not only cast all of the working parts for the fans manufactured by the company, but also will solicit other commercial work.

**Chandeysson Electric Company,** 4092 Bingham Avenue, St. Louis, Mo., is building a one-story addition, 82 x 200 ft., to its electrical equipment plant. Company manufactures motor-generator sets and allied equipment. The addition will cost $40,000. No new equipment is needed at present, it is stated.

**Pritchard-Andrews Company,** Ottawa, Ltd., 264 Sparks Street, Ottawa, Canada, is manufacturing brass and aluminum castings at its foundry at 47 Booth Street, Ottawa. The company specializes in memorial and ecclesiastic brass and bronze work, as well as fittings for banks, stores, offices, etc. **H. M. Pritchard** is secretary-treasurer.

**American Brass Novelty Company,** Grand Haven, Mich., reports the past year one of the best in its history. The plant has been at practically capacity during the entire year. This firm operates the following departments: brass foundry, brass machine shop, tool room, stamping, plating, polishing, grinding room, lacquering, japanning.

**S. and H. Foundry Company,** Mishawaka, Ind., recently organized by **August C. Scherrer** and **Walter A. Hammer,** has begun operations. The company will manufacture aluminum, brass and bronze castings. The initial floor space is 5,000 square feet. This firm operates the following departments: brass, bronze, and aluminum foundry.

**The Magnus Chemical Company, Inc.,** Garwood, New Jersey, announces that it has appointed **Gordon H. Cade** as its industrial representative for Maryland and Delaware with headquarters at Towson, Maryland. Mr. Cade has been a specialist in the field of industrial cleaning for some time, and is well-known in his present territory.

**Divine Brothers Company,** Utica, N. Y., manufacturers of metal finishing equipment and supplies, reports the following officers have been elected for the year 1931: **Bradford H. Divine,** president; **Robert T. Kent,** vice-president; **B. Dalton Divine,** treasurer; **R. Irving Roberts,** secretary and assistant treasurer; **B. M. Beach,** assistant secretary.

**Central Flatiron Manufacturing Company,** Johnson City, New York, has changed its corporate title to **Betsey Ross Electric Products Corporation.** Officers of the company are **H. G. Heckman,** president and treasurer; **R. Z. Spaulding,** vice-president; **Kirk S. Heckman,** secretary. The company has added several new appliances to its line.

**General Electric Company,** Schenectady, N. Y., has begun construction of a million-dollar plant, the first unit of an extensive development at Cleveland, Ohio, where a 23-acre site is owned by the company. This unit will be finished by August 1, and all filament wire and gases for incandescent lamps made by the company will be produced there.

**Kollsman Instrument Company,** Brooklyn, N. Y., has been incorporated with $20,000 capital, to take over firm of same name, manufacturing electrical and aircraft instruments. **Paul Kollsman,** head of the firm, states that they are frequently in the market for limited quantities of non-ferrous metals, as well as some equipment, which is usually furnished by local sources.

**Illinois Testing Laboratories, Inc.,** 141 West Austin Avenue, Chicago, Ill., has appointed **Porter Hurd,** 516 Packard Building, Philadelphia, Pa., as its representative in Eastern Pennsylvania, Southern New Jersey, Delaware and Maryland, for its line of portable and stationary indicating pyrometers, resistance thermometers and other measuring instruments for industrial purposes.

**General Controls Company, Ltd.,** Oakland, Calif., has started the manufacture of automatic fire and pressure controls for gas and oil burners at 241 10th Street, where 3,375 sq. ft. of floor space has been leased, and the products, which are sold under the trade name of "General," are being distributed to points throughout northern California. The company operates the following departments: brass machine shop, soldering, lacquering.

At a meeting of the board of directors of the **Kester Solder Company,** Chicago, Ill., February 17, **F. C. Engelhart** was elected president. Mr. Engelhart has been the directing head of the company for twenty years. **J. A. Reitzel,** formerly sales promotion manager, has been elected to the position of general sales manager. The Kester company is a large manufacturer of solder. Its products include Kester "Metal Mender," acid-core solder, radio solder, rosin-core solder, paste-core solder, body solder and bar solder.

**Economy Street Marker Company,** 213 Littlefield Building, Austin, Texas, is manufacturing the "Simplex" street marker for controlling pedestrian and vehicular traffic. It is made of aluminum alloy and has already had extensive application in various cities. The company states it is interested in acquiring a small tilting furnace for melting and pouring aluminum crank case type alloy, to use gas fuel. The firm is also seeking a manufacturers' agent for the New York territory. The plant of this company includes aluminum foundry, casting shop and polishing department.

**Jantz and Leist Electric Company,** Cincinnati, Ohio, manufacturer of motors and generators, has been placed in receivership by consent of the directors. **William H. Mitchell,** president of Mitchell Steel Company, has been named receiver and will manage the business, which will be continued. The receivership was found necessary in order to conserve the company's assets, according to **O. W. Jantz,** head of the firm, who states that the receiver will have full co-operation of the organization and that all efforts will be made to liquidate claims of creditors. It is hoped to restore the impaired capital position of the concern.

# Review of the Wrought Metal Business

By J. J. WHITEHEAD

President of the Whitehead Metal Products Company of New York, Inc.

MARCH 2, 1931.

Confidence is slowly but surely returning. Perhaps nothing has helped so much as the upturn in the stock market. This, to be sure, has been rather swift, and has about made up the decline of 1930. It is an indication that people with money to invest have about decided that stocks are cheap. If the market is an indicator, perhaps other things, especially commodities, are also cheap.

The demand for copper from abroad has been good during the past month. The brass mills were receiving orders in good volume the latter part of February, and this means that domestic users of copper will soon have to cover their requirements. It would appear that the present price of copper is more likely to hold and increase rather than to slip off again.

Not only have the brass mills received many orders, but this demand for copper, brass and other copper products has been felt all along the line. The orders have increased appreciably in number, but, more important, they are for tonnage quantities. Large users of these products are arranging for their requirements. Every indication at this writing points to a continuation of this demand. It is believed that slowly but surely general business conditions will improve.

The demand for aluminum has shown a remarkably sudden revival. The demand comes from all users, and some of them are doing more than purchasing from hand to mouth.

Nickel as shot and in other forms is in demand. The use of nickel for alloying purposes is good. This was to be expected because the stainless steel manufacturers are now again getting into production on a quantity basis. Use of nickel for other alloying purposes, such as in cast iron, has also shown a pickup.

Monel metal demand has increased and the metal is being used more widely and more extensively than ever before. Its use will continue to grow because this metal has exceptional properties not obtainable in other alloys, and besides, the outstanding promotional efforts of the International Nickel Company are continually finding new uses for this product. Under the circumstances, the tonnage demand for it is bound to keep on growing.

There can be no question but what we have turned the corner, and, while we may have slight let downs, it is felt that every effort will be made to keep things on an even keel and to get them back more nearly to normal. After what we have all been through, this is certainly no time to lose faith; we should look forward with confidence.

# The Metal Market Review

By R. J. HOUSTON

D. Houston and Company, Metal Brokers, New York

## COPPER

MARCH 2, 1931.

Important constructive factors are noticeably at work in the copper situation which are bound eventually to provide increased stimulus and strength both to demand and market conditions. First and most significant is the adjustment of current output to consumption. This is apparent from the fact that total deliveries during December and January were more than 12,000,000 pounds larger than the refinery production for that period. Refined output in January also was the smallest since 1924, and was 122,206,000 pounds below the peak figures of monthly production in 1929. The recently reported decrease in surplus stocks is another fact clearly establishing the trend and that developments are distinctly favorable in the implications. This is bringing a greater measure of confidence in trade circles, and while the progress toward betterment is not on a spectacular scale, there is a feeling that the copper situation is now on a sounder basis than it was several months ago.

Sales of copper in February were in large volume and represented an active consuming demand especially for export shipment. Domestic buying also absorbed a large tonnage of the business done. Price levels in the first half of the month were on the basis of 9½ cents deliverable in the Connecticut Valley zone and 9.80 cents c.i.f. usual European destinations. These low prices proved specially attractive to the principal consumers both here and abroad. Movements into consumption took on greater importance and the scope of business broadened sufficiently to allow both producers and custom smelters active participation in the orders booked. The market developed a firmer tone as buying interest increased. There was therefore a reaction from the low levels current in the early part of the month to 10 cents on domestic business and later to 10¼ cents. The export price was advanced three times in February covering a net gain of three-quarters of a cent per pound, or from 9.80 cents to 10.55 cents c.i.f. European ports. Market at close of month was strong, with prospect of higher prices in near future. It is felt that new fields of activity and broader markets are opening up and will bring about a pronounced revival of demand for copper this year.

## ZINC

Prices of zinc again underwent a downward trend during February. A shinkage in market values and increased tonnages of surplus supplies, however, seem to haunt this commodity with absolute certainty. There have been experiments in production curtailment for many months, but the maladjustment between supply and demand is more apparent now than it was. Smelters' stocks increased 1,500 tons in January and on February 1 amounted to 145,076 tons, as compared with 86,736 tons on February 1, 1930, an increase in 12 months of 58,340 tons. The level of price has declined to 3.95 cents for Prime Western slab zinc on East St. Louis basis. This price is equal to the lowest quotation in 1930 and compares with 5.15 cents a year ago. Present stocks may be strongly held, but although that may be so the existence of heavy over supplies always contributes to a fall in price for any commodity. On the other hand, a balanced situation, with its inherent benefits always creates economic and market stability. Recent deliveries about balanced current output, but market stimulus is lacking in view of the statistical position referred to. Domestic demand has been moderate, but consumers act with caution owing to the pronounced inflation of stocks at primary sources. A firmer tone and better demand was reported at the close, with minimum quotation at 4 cents East St. Louis.

## TIN

Activity of demand and flexibility of market movements were outstanding developments in tin during February. Price fluctuations showed a range of approximately 2 cents a pound, with quotations for prompt Straits tin moving between 25¼ cents and 27.20 cents. Speculative operations were conspicuously heavy in London. The trade was kept in more or less tense state regard-

ing regulation of production and exports. More tangible evidence of progress in this direction led to sharp price advances. The prospect that agreements to balance output to demand will be carried out is now anticipated. The necessity for this action is emphasized by the fact that the total visible supply of tin on February 1 amounted to 43,619 long tons, against 29,032 tons a year ago, an increase of 14,587 tons.

### LEAD

A reactionary mood was apparent in the lead market during the first half of February. Two price reductions occurred in the first week, the net decline being equal to a quarter of a cent per pound. The downward revision placed the market on the basis of 4.30 cents East St. Louis and 4.50 cents New York. Inquiry and demand was stimulated by the more attractive offers and substantial business resulted. Many immediate and forward requirements were covered. Statistics for January were rather unfavorable in that they showed an increase of 9,898 tons in refined stocks during that month. Production, however, registered a decrease of 5,112 tons compared with December output of domestic refined lead and of 6,586 tons compared with January, 1930. On February 19 the New York price was advanced to 4.60 cents and the East St. Louis basis to 4.35 cents. Active demand was renewed at the higher quotations. A diversified buying movement provided a fair outlet for both prompt and nearby supplies.

### ALUMINUM

Trade in aluminum was on a fair scale with an expanding tendency lately. Volume of shipments to consumers increased over those earlier in the year owing to more active requirements noted in the automotive industry. The market for primary grades of the metal continues technically firm, and prices for remelted aluminum are fairly steady.

### ANTIMONY

There were no impressive movements in antimony recently. The market displayed an easy tone in first half of February and spot regulars sold at 7 cents duty paid. China does not appear inclined to press sales at concessions. Prices show a fractional gain to 7.10 cents, but demand is not active and consumers reveal a minimum of interest. Exports of antimony from China in January amounted to 325 tons. This compares with 745 tons in December and 1,006 tons shipped in January, 1930.

### QUICKSILVER

Considerable competition is reported in trade circles, and prices of quicksilver have been easy at $102 to $103 per flask for small lots. Sales of large lots were heard of at $100 per flask. Reduced consumption and free offerings caused irregularity in quotations.

### PLATINUM

Refined platinum has been quiet, with quotations of $27 to $28 an ounce. Some interests quote higher prices for small quantities. Trade estimates place production for 1930 at approximately 210,500 ounces, of which Russia is credited with 120,000 ounces. Output has steadily increased in Canada and South Africa.

### SILVER

There has been progressive depression in silver for many months. Conditions affecting this metal are of such universal importance and consequence that serious international consideration of the problems involved has been recommended by leading interests. The recession in price has been most acute, and there is no sign of any pronounced recovery in keeping with the former status of the article. A new low of 25¾ cents per ounce was touched on February 16.

### OLD METALS

Operations in scrap material were on a moderate scale in February. Firming up of primary copper awakened new interest and expectation, however, and stocks moved more freely. Signs of hesitation developed later due to disappointment when the market for new copper failed to move forward. The situation in secondary metals, as in primary products, is still in a sensitive state. Business, and plenty of it, is in the offing and awaits leadership and action in the big major markets. Current prices are given on the following page.

## Daily Metal Prices for Month of February, 1931

### Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

| | 2 | 3 | 4 | 5 | 6 | 9 | 10 | 11 | 12* | 13 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Copper** c/lb. Duty Free | | | | | | | | | | | | |
| Lake (Del.) | 9.875 | 9.875 | 9.875 | 9.625 | 9.625 | 9.625 | 10.125 | 10.375 | .... | 10.125 | 10.125 | 10.125 |
| Electrolytic (f.a.s. N. Y.) | 9.75 | 9.75 | 9.75 | 9.60 | 9.60 | 9.75 | 10.00 | 10.25 | .... | 10.00 | 10.00 | 10.00 |
| Casting (f.o.b. ref.) | 9.50 | 9.50 | 9.25 | 9.25 | 9.375 | 9.375 | 9.75 | 10.00 | .... | 9.75 | 9.75 | 9.75 |
| **Zinc** (f. o. b. St. L.) c/lb. Duty 1¾c/lb. | | | | | | | | | | | | |
| Prime Western | 4.10 | 4.10 | 4.10 | 4.10 | 4.05 | 4.05 | 4.05 | 4.00 | .... | 4.00 | 4.00 | 4.00 |
| Brass Special | 4.20 | 4.20 | 4.20 | 4.20 | 4.15 | 4.15 | 4.15 | 4.10 | .... | 4.10 | 4.10 | 4.10 |
| **Tin** (f. o. b. N. Y.) c/lb. Duty Free | | | | | | | | | | | | |
| Straits | 25.25 | 25.25 | 26.00 | 25.60 | 25.875 | 26.125 | 26.00 | 26.25 | .... | 25.75 | 25.80 | 26.40 |
| Pig 99% | 24.50 | 24.50 | 25.125 | 24.75 | 25.25 | 25.375 | 25.25 | 25.50 | .... | 25.00 | 24.875 | 25.50 |
| **Lead** (f. o. b. St. L.) c/lb. Duty 2⅛c/lb. | 4.55 | 4.40 | 4.30 | 4.30 | 4.30 | 4.30 | 4.30 | 4.30 | .... | 4.30 | 4.30 | 4.30 |
| **Aluminum** c/lb. Duty 4c/lb. | 23.30 | 23.30 | 23.30 | 23.30 | 23.30 | 23.30 | 23.30 | 23.30 | .... | 23.30 | 23.30 | 23.30 |
| **Nickel** c/lb. Duty 3c/lb. | | | | | | | | | | | | |
| Ingot | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | .... | 35 | 35 | 35 |
| Shot | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | .... | 36 | 36 | 36 |
| Electrolytic | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | .... | 35 | 35 | 35 |
| **Antimony** (J. & Ch.) c/lb. Duty 2c/lb. | 7.125 | 7.10 | 7.10 | 7.10 | 7.05 | 7.05 | 7.00 | 7.10 | .... | 7.10 | 7.10 | 7.10 |
| **Silver** c/oz. Troy Duty Free | 28.125 | 27.125 | 27.25 | 27.125 | 26.50 | 26.125 | 26.875 | 27.625 | .... | 26.125 | 25.75 | 26.00 |
| **Platinum** $/oz. Troy Duty Free | 33.00 | 33.00 | 33.00 | 30.00 | 30.00 | 30.00 | 30.00 | 30.00 | .... | 30.00 | 30.00 | 30.00 |

| | 18 | 19 | 20 | 23* | 24 | 25 | 26 | 27 | High | Low | Aver. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Copper** c/lb. Duty Free | | | | | | | | | | | |
| Lake (Del.) | 10.375 | 10.375 | 10.625 | .... | 10.625 | 10.625 | 10.625 | 10.625 | 10.625 | 9.625 | 10.181 |
| Electrolytic (f.a.s. N. Y.) | 10.25 | 10.25 | 10.50 | .... | 10.50 | 10.50 | 10.50 | 10.50 | 10.50 | 9.60 | 10.081 |
| Casting (f.o.b. ref.) | 10.00 | 10.00 | 10.25 | .... | 10.25 | 10.25 | 10.25 | 10.25 | 10.25 | 9.25 | 9.806 |
| **Zinc** (f. o. b. St. L.) c/lb. Duty 1¾c/lb. | | | | | | | | | | | |
| Prime Western | 4.00 | 3.95 | 3.95 | .... | 3.95 | 4.00 | 4.00 | 4.05 | 4.10 | 3.95 | 4.025 |
| Brass Special | 4.10 | 4.05 | 4.05 | .... | 4.05 | 4.10 | 4.10 | 4.15 | 4.20 | 4.05 | 4.125 |
| **Tin** (f. o. b. N. Y.) c/lb. Duty Free | | | | | | | | | | | |
| Straits | 26.70 | 27.125 | 27.05 | .... | 27.20 | 27.15 | 27.00 | 27.00 | 27.20 | 25.25 | 26.307 |
| Pig 99% | 25.85 | 26.375 | 26.35 | .... | 26.50 | 26.375 | 26.25 | 26.25 | 26.50 | 24.50 | 25.532 |
| **Lead** (f. o. b. St. L.) c/lb. Duty 2⅛c/lb. | 4.30 | 4.35 | 4.35 | .... | 4.35 | 4.35 | 4.35 | 4.35 | 4.55 | 4.30 | 4.336 |
| **Aluminum** c/lb. Duty 4c/lb. | 23.30 | 23.30 | 23.30 | .... | 23.30 | 23.30 | 23.30 | 23.30 | 23.30 | 23.30 | 23.30 |
| **Nickel** c/lb. Duty 3c/lb. | | | | | | | | | | | |
| Ingot | 35 | 35 | 35 | .... | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| Shot | 36 | 36 | 36 | .... | 36 | 36 | 36 | 36 | 36 | 36 | 36 |
| Electrolytic | 35 | 35 | 35 | .... | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| **Antimony** (J. & Ch.) c/lb. Duty 2c/lb. | 7.10 | 7.10 | 7.10 | .... | 7.10 | 7.10 | 7.10 | 7.05 | 7.125 | 7.00 | 7.088 |
| **Silver** c/oz. Troy Duty Free | 26.375 | 27.00 | 26.25 | .... | 27.125 | 26.625 | 26.875 | 27.00 | 28.125 | 25.75 | 26.771 |
| **Platinum** $/oz. Troy Duty Free | 30.00 | 28.00 | 28.00 | .... | 28.00 | 28.00 | 28.00 | 28.00 | 33.00 | 28.00 | 29.833 |

*Holiday.

# Metal Prices, March 9, 1931

## NEW METALS

**Copper**: Lake, 10.625. Electrolytic, 10.25. Casting, 10.00.
**Zinc**: Prime Western, 4.05. Brass Special, 4.15.
**Tin**: Straits, 27.35. Pig, 99%, 26.45.
**Lead**: 4.35. **Aluminum**, 23.30. **Antimony**, 7.15.
**Nickel**: Ingot, 35. Shot, 36. Elec., 35. Pellets, 40.
**Quicksilver**: flask, 75 lbs., $104. **Bismuth**, $125.
**Cadmium**, 55. **Cobalt**, 97%, $2.50. **Silver**, oz., Troy (N. Y. official price March 9) 29.00.
**Gold**: oz., Troy, $20.67. **Platinum**, oz., Troy, $27.00.

## INGOT METALS AND ALLOYS

| | |
|---|---|
| Brass Ingots, Yellow | 7½to10 |
| Brass Ingots, Red | 10 to12 |
| Bronze Ingots | 11 to14 |
| Casting Aluminum Alloys | 19 to22 |
| Manganese Bronze Castings | 22 to37 |
| Manganese Bronze Ingots | 9 to11 |
| Manganese Bronze Forgings | 35 to43 |
| Manganese Copper, 30% | 23 to30 |
| Monel Metal Shot | 28 |
| Monel Metal Blocks | 28 |
| Manganese Bronze Ingots | 16 to18 |
| Phosphor Bronze Ingots | 11 to13 |
| Phosphor Copper, guaranteed 15% | 14¾to16 |
| Phosphor Copper, guaranteed 10% | 14 to15½ |
| Phosphor Tin, no guarantee | 33 to40 |
| Silicon Copper, 10%, according to quantity | 25 to35 |

## OLD METALS

| Buying Prices | | Selling Prices |
|---|---|---|
| 8¼to 8½ | Crucible Copper | 9¼to 9½ |
| 7½to 8 | Heavy Copper and Wire, mixed | 8½to 9 |
| 7¾to 8 | Light Copper | 8¾to 9 |
| 4⅞to 5⅛ | Heavy Brass | 5⅞to 6⅛ |
| 3¾to 4¼ | Light Brass | 4¾to 5¼ |
| 7¼to 7½ | No. 1 Composition | 8¼to 8½ |
| 6½to 7 | Composition Turnings | 7½to 8 |
| 3⅜to 3⅝ | Heavy Lead | 4⅜to 4⅝ |
| 1½to 2 | Old Zinc | 2½to 3 |
| 2¼to 2½ | New Zinc Clips | 3¼to 3½ |
| 12½to13½ | Aluminum Clips (new) | 14 to16 |
| 4½to 5 | Scrap Aluminum, cast, mixed | 6 to 8 |
| 8½to 9½ | Scrap Aluminum sheet (old) | 10 to12¼ |
| 16½to17½ | No. 1 Pewter | 20½to22½ |
| 22 to24 | Nickel Anodes | 24 to26 |
| 24 to26 | Nickel scrap (new) | 26 to30 |

# Wrought Metals and Alloys

## COPPER SHEET

| | |
|---|---|
| Mill shipment (hot rolled) | 20⅜c. to 21⅜c. net base |
| Front Stock | 21⅜c. to 22⅜c. net base |

## BARE COPPER WIRE

12¼c. to 12½c. net base, in carload lots.

## COPPER SEAMLESS TUBING

22⅞c. to 23⅞c. net base.

## SOLDERING COPPERS

| | |
|---|---|
| 300 lbs. and over in one order | 18¾c. net base |
| 100 lbs. to 300 lbs. in one order | 19¼c. net base |

## ALUMINUM SHEET AND COIL

| | |
|---|---|
| Aluminum sheet, 18 ga., base, ton lots, per lb. | 32.30 |
| Aluminum coils, 24 ga., base price | 30.00 |

## ROLLED NICKEL SHEET AND ROD

Net Base Prices

| | | | |
|---|---|---|---|
| Cold Drawn Rods | 50c. | Cold Rolled Sheet | 60c. |
| Hot Rolled Rods | 45c. | Full Finished Sheet | 52c. |

## BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 12c. over N. Y. Pig Tin; 50 to 100 lbs., 18c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over.

## SILVER SHEET

Rolled sterling silver (March 9) 32.25c. Troy oz. upward, according to quantity.

## BRASS MATERIAL—MILL SHIPMENTS

In effect from March 2, 1931
To customers who buy 5,000 lbs. or more in one order

| | Net base per lb. | | |
|---|---|---|---|
| | High Brass | Low Brass | Bronze |
| Sheet | $0.17⅝ | $0.19 | $0.19¾ |
| Wire | .18⅛ | .19½ | .20¼ |
| Rod | .15⅞ | .19½ | .20¼ |
| Brazed tubing | .25½ | ..... | .29⅝ |
| Open seam tubing | .25⅝ | ..... | .27¾ |
| Angles and channels | .25⅝ | ..... | .27¾ |

## BRASS SEAMLESS TUBING

22½c. to 23½c. net base.

## TOBIN BRONZE AND MUNTZ METAL

| | |
|---|---|
| Tobin Bronze Rod | 19½c. net base |
| Muntz or Yellow Metal Sheathing (14"x48") | 19⅝c. net base |
| Muntz or Yellow Rectangular sheet other sheathing | 19⅝c. net base |
| Muntz or Yellow Metal Rod | 16¾c. net base |

Above are for 100 lbs. or more in one order

## NICKEL SILVER (NICKELENE)

Net Base Prices

| Grade "A" Sheet Metal | | Wire and Rod | |
|---|---|---|---|
| 10% Quality | 25⅜c. | 10% Quality | 28½c. |
| 15% Quality | 27⅝c. | 15% Quality | 32½c. |
| 18% Quality | 28⅞c. | 18% Quality | 36c. |

## MONEL METAL, SHEET AND ROD

| | | | |
|---|---|---|---|
| Hot Rolled Rods (base) | 35 | Full Finished Sheets (base) | 42 |
| Cold Drawn Rods (base) | 40 | Cold Rolled Sheets (base) | 50 |

## BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 10c. over N. Y. tin price; 100 lbs. to 500 lbs., 12c. over; 50 to 100 lbs., 18c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over. Prices F. O. B. mill.

# Supply Prices, March 9, 1931

## ANODES

| | | |
|---|---|---|
| **Copper:** Cast | 21⅛c. per lb. | |
| Rolled, sheets, trimmed | 18⅝c. per lb. | |
| Rolled, oval | 18⅝c. per lb. | |
| **Brass:** Cast | 20⅛c. per lb. | |
| **Zinc:** Cast | 11¼c. per lb. | |

| | |
|---|---|
| **Nickel:** 90-92% | 45c. per lb. |
| 95-97% | 47c. per lb. |
| 99% | 49c. per lb. |

**Silver:** Rolled silver anodes .999 fine were quoted Mar. 9 from 32.00c. per Troy ounce upward, depending upon quantity.

## FELT POLISHING WHEELS WHITE SPANISH

| Diameter | Thickness | Under 50 lbs. | 50 to 100 lbs. | Over 100 lbs. |
|---|---|---|---|---|
| 10-12-14 & 16 | 1" to 2" | $3.00/lb. | $2.75/lb. | $2.65/lb. |
| 10-12-14 & 16 | 2 to 3½ | 3.00 | 2.70 | 2.50 |
| 6-8 & over 16 | 1 to 3½ | 3.10 | 2.85 | 2.70-2.75 |
| 6 to 24 | Under ½ | 4.25 | 4.00 | 3.90 |
| 6 to 24 | ½ to 1 | 4.00 | 3.75 | 3.65 |
| 6 to 24 | Over 3 | 3.40 | 3.15 | 3.05 |
| 4 to 6 | ¼ to 3 | 4.85 | 4.85 | 4.85 |
| 4 to 6 | Over 3 | 5.25 | 5.25 | 5.25 |
| Under 4 | ¼ to 3 | 5.45 | 5.45 | 5.45 |
| Under 4 | Over 3 | 5.85 | 5.85 | 5.85 |

On grey Mexican wheels deduct 10c. per lb. from White Spanish.

## COTTON BUFFS

Full Disc Open buffs, per 100 sections.

| | |
|---|---|
| 11" 20 ply 64/68 Unbleached | $16.38 to 20.28 |
| 14" 20 ply 64/68 Unbleached | 24.32 to 30.12 |
| 11" 20 ply 80/92 Unbleached | 21.60 to 26.75 |
| 14" 20 ply 80/92 Unbleached | 31.83 to 39.42 |
| 11" 20 ply 84/92 Unbleached | 24.93 to 35.59 |
| 14" 20 ply 84/92 Unbleached | 37.03 to 52.80 |
| 11" 20 ply 80/84 Unbleached | 26.35 to 32.63 |
| 14" 20 ply 80/84 Unbleached | 39.06 to 48.38 |

Sewed Pieced Buffs, per lb., bleached ... 30c. to 79c.

## CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

| | | |
|---|---|---|
| Acetone | lb. | .09¾-.14 |
| Acid—Boric (Boracic) Crystals | lb. | .07¾ |
| Chromic, 75 to 400 lb. drums | lb. | .16½-.20 |
| Hydrochloric (Muriatic) Tech., 20 deg., carboys | lb. | .02 |
| Hydrochloric, C. P., 20 deg., carboys | lb. | .06 |
| Hydrofluoric, 30%, bbls. | lb. | .08 |
| Nitric, 36 deg., carboys | lb. | .06 |
| Nitric, 42 deg., carboys | lb. | .07 |
| Sulphuric, 66 deg., carboys | lb. | .02 |
| Alcohol—Butyl | lb. | .15¾-.21¼ |
| Denatured, drums | gal. | .39-.50 |
| Alum—Lump, barrels | lb. | .03¼-.04 |
| Powdered, barrels | lb. | .03½-.04 |
| Ammonium chloride | lb. | .0458 |
| Ammonium sulphate, tech., bbls. | lb. | .03½ |
| Sulphocyanide | lb. | .65 |
| Arsenic, white, kegs | lb. | .05 |
| Asphaltum | lb. | .35 |
| Benzol, pure | gal. | .58 |
| Borax Crystals (Sodium Biborate), bbls. | lb. | .04½ |
| Calcium Carbonate (Precipitated Chalk) | lb. | .04 |
| Carbon Bisulphide, Drums | lb. | .06 |
| Chrome Green, bbls. | lb. | .24 |
| Chromic Sulphate | lb. | .30-.40 |
| Copper—Acetate (Verdigris) | lb. | .23 |
| Carbonate, bbls. | lb. | .16½ |
| Cyanide (100 lb. kgs.) | lb. | .41 |
| Sulphate, bbls. | lb. | 4 65 |
| Cream of Tartar Crystals (Potassium Bitartrate) | lb. | .27 |
| Crocus | lb. | .15 |
| Dextrin | lb. | .05-.08 |
| Emery Flour | lb. | .06 |
| Flint, powdered | ton | $30.00 |
| Fluor-spar (Calcic fluoride) | ton | $70.00 |
| Fusel Oil | gal. | $4.45 |
| Gold Chloride | oz. | $12.00 |
| Gum—Sandarac | lb. | .26 |
| Shellac | lb. | .59-.61 |
| Iron Sulphate (Copperas), bbl. | lb. | .01½ |
| Lacquer Solvents | gal. | .85 |
| Lead Acetate (Sugar of Lead) | lb. | .13¼ |
| Yellow Oxide (Litharge) | lb. | .12½ |
| Mercury Bichloride (Corrosive Sublimate) | lb. | $1.58 |
| Nickel—Carbonate, dry bbls. | lb. | .32 |
| Chloride, bbls. | lb. | .18 |
| Salts, single, 300 lb. bbls. | lb. | .10½-.13 |
| Salts, double, 425 lb. bbls. | lb. | .10½-.13 |
| Paraffin | lb. | .05-.06 |
| Phosphorus—Duty free, according to quantity | lb. | .35-.40 |
| Potash Caustic Electrolytic 88-92% broken, drums | lb. | .083 |
| Potassium Bichromate, casks (crystals) | lb. | .09¼ |
| Carbonate, 96-98% | lb. | .06¼-.07 |
| Cyanide, 165 lbs. cases, 94-96% | lb. | .57½-.60 |
| Pumice, ground, bbls. | lb. | .02½ |
| Quartz, powdered | ton | $30.00 |
| Rosin, bbls. | lb. | .04½ |
| Rouge, nickel, 100 lb. lots | lb. | .25 |
| Silver and Gold | lb. | .65 |
| Sal Ammoniac (Ammonium Chloride) in bbls. | lb. | .05¼ |
| Silver Chloride, dry, 100 oz. lots | oz. | .25¾ |
| Cyanide (fluctuating) | oz. | .33 |
| Nitrate, 100 ounce lots | oz. | .22½ |
| Soda Ash, 58%, bbls. | lb. | .023 |
| Sodium—Cyanide, 96 to 98%, 100 lbs. | lb. | .17 |
| Hyposulphite, kegs | lb. | .03½-.04 |
| Nitrate, tech., bbls. | lb. | .03½ |
| Phosphate, tech., bbls. | lb. | .03¾ |
| Silicate (Water Glass), bbls. | lb. | .02 |
| Sulpho Cyanide | lb. | .32½-.42½ |
| Sulphur (Brimstone), bbls. | lb. | .02 |
| Tin Chloride, 100 lb. kegs | lb. | .28 |
| Tripoli, Powdered | lb. | .03 |
| Wax—Bees, white, ref. bleached | lb. | .60 |
| Yellow, No. 1 | lb. | .45 |
| Whiting, Bolted | lb. | .02½-.06 |
| Zinc, Carbonate, bbls. | lb. | .11 |
| Chloride, casks | lb. | .06¾ |
| Cyanide (100 lb. kegs) | lb. | .38 |
| Sulphate, bbls. | lb. | .03½ |